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ERRATA.

Page 26 line 18 for "*aisset Soleaeia*" read "*Saissetia oleae*"
,, 55 ,, 30 ,, "*lebek*" read "*lebbek*"
,, 56 ,, 27 ,, "vii" read "viii"
,, 100 ,, 12 ,, "adhesive" read "shelter"
,, 126 ,, 15 ,, "ISLEY" read "ISELY"
,, 137 ,, 27 ,, "DELONG (M.)" read "DELONG (D. M.)"
,, 143 ,, 25 ,, "*padulosa*" read "*paludosa*"
,, 144 ,, 27 ,, "MORGENTHALER (D.)" read "MORGENTHALER (O.)"
,, 175 ,, 23 ,, "EBERLING (W.)" read "EBELING (W.)"
,, 214 ,, 6 ,, "(*Topeutes*)" read "(*Topeutis*)"
,, 240 nine lines from end for "east" read "west"
,, 247 line 23 for "lacewing" read "Encyrtid"
,, 249 nine lines from end for "*indigatrix*" read "*indagatrix*"
,, 252 line 30 for "*pellicidus*" read "*pellucidus*"
,, 291 ,, 34 ,, "C. M. Cutright" read "C. R. Cutright"
,, 293 ,, 35 ,, **"Burrill"** read **"Burrell"**
,, 319 ,, 13 ,, "*Cornesiella*" read "*Comesiella*"
,, 343 lines 24 and 25 for "(*Agrostalgmus*)" read "(*Acrostalagmus*)"
,, 378 three lines from end for "*recticularis*" read "*reticularis*"
,, 380 line 37 for "*Anconura*" read "*Aconura*"
,, 456 line 1 for "JENSEN-STORCH (S. V.)" read "JENSEN-STORCH (S.)"
,, 464 ,, 27 ,, "*marginata*" read "*emarginata*"
,, 469 lines 38 and 39 for "*indigator*, Walsh." read "*indagatrix*, Cress"
,, 496 line 4 for "*Zamara*" read "*Zamacra*"
,, 507 ,, 5 ,, "*Lioceris*" read "*Lilioceris*"
,, 577 3 lines from end for "*betulae*" read "*betulus*"
,, 581 line 29 for "peas" read "pear"
,, 594 four lines from end for "*Midas*" read "*Midus*"
,, 653 line 18 for "*Phanomerus*" read "*Phanomeris*"
,, 679 ,, 28 ,, "238" read "228"
,, 709 ,, 26 ,, "G. T. Gimingham" read "C. T Gimingham"

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IMPERIAL INSTITUTE OF ENTOMOLOGY.

REVIEW
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APPLIED ENTOMOLOGY.

SERIES A.

Vol. XX.] [1932.

MACDOUGALL (R. S.). **Insect Pests.—No. XII.**—*Scot. J. Agric.*, xiv, no. 4, pp. 414–423, 4 figs., 6 refs. Edinburgh, October 1931.

Very brief notes are given on the bionomics of Tachinids, Syrphids and Diptera in general, and a number of the Cecidomyiids that are injurious to crops in Britain are dealt with in rather more detail, reference being made to the work of Barnes [*R.A.E.*, A, xv, 581; xvii, 21; xviii, 501]. Of the species infesting cereals, *Mayetiola destructor*, Say, which attacks wheat, barley and occasionally rye, but is seldom a serious pest in Britain, and *Haplodiplosis equestris*, Wagn., which infests wheat, are sometimes confused; characters distinguishing them are indicated, one being that the former pupates on the plant and the latter in the soil. Of the species that attack clover, *Amblyspatha ormerodi*, Kieff., has been recorded as injurious in various parts of England. The eggs are probably laid on the unopened buds or on the young leaves, and the larvae may be found in almost any part of the plant. Pupation takes place in the soil.

JARY (S. G.). *Macrosiphum tanaceticolum* (**Kalt.**) **on Chrysanthemums.**—*Ent. Mon. Mag.*, lxvii, no. 811, p. 280. London, December 1931.

In late October, *Macrosiphum tanaceticolum*, Kalt., was found on chrysanthemums in Sussex. It occurred chiefly in the uppermost leaves and flower heads, attracting attention by the red stain produced when it was crushed. Tansy (*Tanacetum vulgare*), the food-plant from which it was originally described, grew in profusion nearby, and some dead tansy plants had been thrown on the soil near the chrysanthemums, though whether the Aphid occurred on the former is not known. It is apparently a rare species and has never before been recorded from chrysanthemums in England.

BOVINGDON (H. H. S.). **Pests in Cured Tobacco. The Tobacco Beetle,** *Lasioderma serricorne* **Fab., and the Cacao Moth,** *Ephestia elutella* **Hb.**—*Tobacco*, 1st August 1931, reprint 4 pp., 12 figs. London, 1931.

Ephestia elutella, Hb., has recently been found attacking stored tobacco in Britain, Bulgaria, Russia and Virginia [*cf.* also *R.A.E.*, A, xix, 382], and it seems probable that it may prove a more serious pest

than *Lasioderma serricorne*, F. The morphology and bionomics of these two insects and the damage they cause are described and compared, and characters distinguishing them in all stages are tabulated. *L. serricorne* lays about 30 eggs in the folds of the bundled leaves, oviposition continuing for about 3 weeks. At 70° F., hatching occurs in about 8 days. The larvae make long cylindrical galleries through the leaves, and in the earlier stages may migrate from infested to uninfested material. They are negatively phototropic, and when exposed, will quickly hide in dark places. A variety of vegetable matter may be attacked, though infestation is mostly found in cured tobacco leaf and in all kinds of manufactured tobaccos. The milder and sweeter types of tobacco are preferred. Under favourable conditions of high uniform heat and humidity and in closely packed tobacco, the larval stage lasts about 5 weeks. Under adverse conditions it may occupy 10 weeks or more. At about 60° F. the larvae become dormant and in this condition may hibernate. The pre-pupal and pupal periods, which are passed in a cell in the tobacco, last 2–3 weeks. The adults, which are strong fliers, are active in subdued light or darkness at temperatures above 65° F. At a constant high temperature and humidity 5 or 6 overlapping generations may be produced annually, but probably only 1 occurs in England where the mean outdoor temperature only exceeds 60° F. during 1–2 months. In many cases the beetles are killed soon after their arrival from abroad.

At a temperature of about 79° F. and a relative humidity of 75–85 per cent. the eggs of *E. elutella* hatch in about 6 days. They are laid on tobacco lying open in the factory or exposed through holes in the hessian bales or casks, a decided preference being shown for the flue-cured types. The larvae, which normally feed for 50–60 days and spin fine silken threads, attack almost every kind of bright flue-cured leaf, making large irregular holes and avoiding the veins. Experimentally they will not feed on the fire-cured types. They leave the tobacco during late summer and autumn to pupate and are found in silken cocoons generally in folds of hessian or in crevices in the casks, walls or the floor. The pre-pupal stage lasts 1–2 days, and the pupal an average of 10. The moths live for about 9 days.

DE FLUITER (H. J.). **De bloedluis** *Eriosoma lanigerum* (**Hausm.**) **in Nederland.** [The Woolly Aphis in Holland.]—viii+126 pp., 16 pls., 4 pp. refs. Wageningen, 1931. (Proefschrift Univ. Leiden.)

The first section of this thesis on *Eriosoma lanigerum*, Hausm., in Holland deals with its synonymy, popular names, geographical distribution, food-plants and economic status, as well as its developmental cycles in America and in Europe. The second describes the author's work in 1928–1930 and the technique employed, his remarks on each subject discussed being prefaced by a review of the results of other workers.

In an experiment to test the importance of the virginogeniae and their progeny in the spread of this Aphid, 123 mature virginogeniae on an apple twig placed in water containing apple-juice produced 4,207 larvae in 9 days, an average of 34 per mature individual. The mature virginogeniae died after a starvation period of 4 days, during which time, however, the maximum number of offspring was still 31 per mature individual. Infested branches that have been cut off must therefore be destroyed at once. The progeny of virginogeniae also died after a starvation period of 4 days. Vaseline bands on the trunks of apple

trees indicated a migration in autumn from October onwards, probably from the aerial parts to the roots or from the crown to the lower portions, such as the rough bark on the stem.

As in other countries, alate individuals occur in Holland. There are two forms, virginoparae, producing larvae with a well developed proboscis, and sexuparae, producing larvae without this organ. The virginoparae appeared at Leyden in 1928 and 1929 in late summer at about the same date as the first sexuparae. In 1930 at Wageningen the virginoparae appeared in the last week of July, whereas the sexuparae appeared at the end of August as before. The alate virginoparae are present in very small numbers indeed and only sporadically. No alate individuals were seen after 3rd November, the colonies then consisting only of virginogeniae and their progeny destined for hibernation. The " swarming " of the winged Aphids occurs chiefly in sunny weather at the warmest time of day. In most cases the offspring are produced after 4 days, after which the parent dies. The maximum was 10, both for sexuparae and virginoparae, 3–6 being the usual number. The sexuparae produce both sexes, but females only are often produced, and occasionally males only. In one instance the progeny included larvae with a long proboscis as well as sexuales [*cf. R.A.E.*, A, xviii, 602]. The males are always less numerous than the females, but are more common in autumn. The progeny of the sexuparae are the sexed generation, the females of which in America lay the winter egg on the American elm (*Ulmus americana*), the resultant fundatrix larva forming the rosette gall on the buds. Experimentally, the author also obtained the winter eggs, and fundatrix larvae hatched in early spring, but failed to infest American elm, Dutch elm (*U. campestris*) or apple. Sexuparae that had already produced numerous sexuales were also placed on American and Dutch elms, but no infestation resulted. The sexuparous generation, which is very numerous on apple in autumn, seems therefore of no importance in the spread of *E. lanigerum* in Holland; its appearance actually reduces the size of colonies, so that a considerably smaller number of individuals hibernate on apple. The sexuales are mature after 8–10 days, the males moulting three times and the females four (in one instance three). No fifth moult has been observed. Mating can occur immediately after the final moult, and a male can fertilise several females.

Experimentally, apterous virginogeniae were successfully established on *Crataegus oxyacantha* and on a pear seedling, but such infestations have never been seen in nature in Holland, where apple is the only foodplant. Hibernation occurs as a young larva, in cracks in the bark or old canker swellings and on the roots. In nature no hibernation of the egg has been observed.

The final part of the paper deals with morphology, the forms described being the apterous virginogenia (mature individual, first-stage larva), nymph, alate sexupara, alate virginopara, progeny (with long proboscis) of the alate virginoparae, sexuales (all stages of the female and first-stage of the male), and fundatrix larva (first-stage).

DE VIN (T. J.). **Iets over kersen.** [Some Notes on Cherries.]—*Tijdschr. Plantenziekt.*, xxxvii, no. 8, pp. 164–166. Wageningen, August 1931.

An increased crop on cherry trees sprayed with carbolineum in Holland is sometimes ascribed to control of the cherry moth, *Argyresthia ephippiella*, F. Without questioning the value of this spray against various pests, the author suggests that in 1931 heavy rains early in

May destroyed many cherry blossoms, and that trees sprayed with carbolineum suffered less loss because it retards the date of blossoming.

ROEPKE (W.). **De " Nachfrass " van den berkenspintkever.** [The Maturation Feeding of the Birch Cambium Beetle.]—*Tijdschr. Plantenziekt.*, xxxvii, no. 8, pp. 161–163, 1 pl. Wageningen, August 1931.

In observations in Holland on the maturation feeding of *Scolytus ratzeburgi*, Jans., which attacks birch, holes were bored inside the forks formed by lateral twigs on branches 6–8 years old, the mines slanting so as to lie in the cambium. Observations on the maturation feeding of Scolytids are of interest, since in the case of *S. scolytus*, F., this feeding has been found to spread *Graphium ulmi*, which causes Dutch elm disease [*R.A.E.*, A, xix, 499].

FRANSEN (J. J.). **De verbreiding der iepenziekte door de iepenspintkevers en de bestrijding van dit insect in de practijk.** [The Spread of Dutch Elm Disease by Elm Cambium Beetles and the Control of this Insect in Practice.]—*Tijdschr. Plantenziekt.*, xxxvii, no. 9, pp. 169–183, 3 pls., 16 refs. Wageningen, September 1931.

Much of the information in this lecture on the spread of *Graphium ulmi*, the fungus causing Dutch elm disease, by *Scolytus scolytus*, F., and on the control of this Scolytid has already been noticed [*R.A.E.*, A, xix, 499]. The submersion in water of infested logs, though inadequate [*loc. cit.*], is preferable to leaving them on the ground. Burning infested bark is expensive and requires to be done repeatedly from early spring to late autumn because of the short duration of each generation. The application of fluid insecticides is to be tried in view of de Jong's results in the Netherlands Indies against borers in *Albizzia* [xix, 517]. Stacks of felled trunks afford particularly favourable breeding-places for *S. scolytus* because of the absence of natural enemies. If such logs are already infested, the bark must be removed and burnt. Uninfested logs are best stored under water, as removal of the bark is costly and depreciates the timber. In experiments with repellents, no apparent infestation occurred for 43 days after application of various coal-tar products, further tests with which are being made.

The Braconid, *Coeloides scolyticida*, Wesm. [xix, 499] is of great value in the control of *S. scolytus*, the rate of parasitism sometimes reaching 100 per cent. It appears to have many generations a year, and oviposits in the bark close to the larva or pupa of the beetle. It is proposed to propagate it artificially on a large scale. The Nematode, *Rhabditolaimus leuckarti*, is not of much importance, as only some of the larvae parasitised by it are killed. Woodpeckers were very active in the winter of 1929–30 in destroying larvae and pupae. In a discussion following this paper (pp. 184–187) it was pointed out that *C. scolyticida* does not occur in all the districts where *S. scolytus* is found, and its artificial distribution would therefore be of value.

FEYTAUD (J.). **Recherches sur le Doryphore** (*Leptinotarsa decemlineata* **Say). Première partie : Observations biologiques.**—*Ann. Epiphyties*, xvi (1930), no. 6, pp. 303–390, 21 figs., 6 refs. Paris, 1931.

The author has continued his studies of *Leptinotarsa decemlineata*, Say (Colorado potato beetle) in France [*R.A.E.*, A, xii, 140] and presents a very comprehensive account of the results, dealing in detail

with the anatomy of the insect, its reproduction and development, method of feeding with consequent injury to the food-plants, and resistance to starvation. It is of interest to note that the starvation experiments showed that overwintered adults may survive without food for up to 12 weeks. Pupation and hibernation are fully described, and preliminary experiments in which an attempt has been made to influence the normal periods of activity and inaction are recorded. The methods of dispersal and migration of the insect are discussed, and maps illustrate its gradual dissemination during the years 1924 to 1930 over the potato-growing regions of the south-west, west and centre of France.

MARCHAL (P.) & FOEX (E.). **Rapport phytopathologique pour l'année 1930.**—*Ann. Epiphyties*, xvii, no. 1, pp. 1–61, refs. Paris, 1931.

The organisation of the campaign against *Leptinotarsa decemlineata*, Say (Colorado potato beetle) in France in 1930, for which the sum of *Fr.* 3,700,000 was appropriated, is described; recent work on insecticides and fungicides is reviewed, and notes are given on the chief insect pests occurring during the year.

Rapports sommaires sur les travaux accomplis dans les laboratoires en 1930.—*Ann. Epiphyties*, xvii, no. 1, pp. 62–112, refs. Paris, 1931.

Among fumigants tested against Bruchids at the Paris Station under P. Marchal, the most promising results were shown by calcium cyanide, carbon bisulphide and mixtures of benzine or carbon bisulphide with tetrachlorethane. Against insect larvae in soil the best fumigant was a mixture of equal parts of benzine and tetrachlorethane rendered miscible in water by the addition of 20 per cent. of sodium sulphoricinate.

From the Bordeaux Station, J. Feytaud reports that the rearing of the natural enemies of *Leptinotarsa decemlineata*, Say (Colorado potato beetle) received from America [*cf. R.A.E.*, A, xix, 585] has not been very successful. *Lebia grandis*, Hentz, did not oviposit, and eggs laid by *Podisus maculiventris*, Say, did not hatch, but it has been proved possible to rear further generations of *Doryphorophaga aberrans*, Towns., and *Perillus bioculatus*, F. The number of individuals obtained was too small, however, for their establishment, and it is evident that introductions on a larger scale will have to be made. The sawfly attacking plums in the Agen district has proved to be *Hoplocampa flava*, L. [see next paper]. The artificial dissemination of *Aphelinus mali*, Hald. [against *Eriosoma lanigerum*, Hausm.] has been continued with much success.

In the Saint-Genis-Laval region, A. Paillot records the occurrence in unusually large numbers of *Myzus persicae*, Sulz., and *Anuraphis amygdali*, Buckt., on peach, *Aphis pomi*, DeG. (*mali*, F.) on apple, pear and quince, and *Anuraphis roseus*, Baker (*Aphis sorbi*, auct.) on apple and pear. On pear, *Aphis pyraria*, Pass., was also injurious to a less extent, especially in June after the migration of *Anuraphis roseus*. *Myzus cerasi*, F., continues to reproduce parthenogenetically on cherries late into the autumn, and immature sexuparae have even been observed in December. In many cases the amount of blossom produced by apple trees was unusually small, and the losses caused by *Anthonomus pomorum*, L., were consequently all the more severe.

FEYTAUD (J.). **Quelques remarques de faunistique.**—*Proc.-verb. Soc. linn. Bordeaux*, lxxxii, pp. 61–63, 1 ref. Bordeaux, 1930.

It has usually been supposed that the sawfly attacking plum in the Agen district was *Hoplocampa fulvicornis*, Panz. (*minuta*, Christ). The author has, however, for two years obtained only adults of *H. flava*, L., from larvae from plums in this district. The confusion may possibly have been due to *H. fulvicornis* having been replaced by *H. flava*, but it is at least certain that the latter is now dominant.

Icerya purchasi, Mask., was recorded from various districts in south-western France during 1928–30. It seems to have been controlled in some districts, but in the Basque country it appears to have become established, and *Rodolia* (*Novius*) *cardinalis*, Muls., is being bred to combat it [*cf. R.A.E.*, A, xix, 275].

WILLE (J.). *Lasioderma serricorne* **F. als Schädling an Baumwollsamen.** [*L. serricorne* as a Pest of Cotton Seeds.]—*Anz. Schädlingsk.*, vii, no. 10, pp. 110–112, 2 refs. Berlin, 15th October 1931.

The tobacco beetle, *Lasioderma serricorne*, F., was found in January 1930 in an oil factory in Peru breeding in cotton seeds that had previously been damaged mechanically during harvesting, or attacked by fungi or other insects. Further observations showed that the beetle was also present in numbers in cotton fields [*cf. R.A.E.*, A, xviii, 422], infesting the so-called " cocopa " bolls, *i.e.*, those that have the fibre joined together and stained as a result of unfavourable weather, badly timed irrigation, or infestation by the Pyralid, *Mescinia peruella*, Schaus, or by *Dysdercus ruficollis*, L. When the cotton is collected, some of the fibre in these bolls usually remains on the plants, eventually dropping to the ground, and is attacked by *Lasioderma*. As the number of cocopa bolls left in the field gradually increases towards the end of the harvest season, the infestation reaches its maximum in July. The cultivation of new biennial or perennial cotton plants takes place in September and October, and as no bolls appear until December, the breeding of the beetle is limited to the defective fibre on the ground, the rate of infestation being then at its minimum. In Peru *L. serricorne* has five generations between September and April, inclusive, and one or two in the winter months (May–August). Eggs are deposited on the partly or completely dry walls of the bolls, or on the compressed fibre, should it be exposed ; the larvae at first feed on the fibre or the shrivelled boll, and eventually bore into the seeds, of which each larva damages several and with which they are carried into the store rooms. Pupation occurs inside the seeds or at the bottom of the boll in an oval cell filled with frass. Though *L. serricorne* only attacks damaged bolls, it is of considerable importance, owing to the injury caused to the cocopa cotton and the depreciation of its market value.

Fumigation of infested seeds in store rooms is not necessary in view of the short time that elapses before the seed is taken to the oil factories for crushing. For control in the field, clean cultivation is recommended. In districts where the growing of perennial cotton has been abandoned, a marked decrease in the numbers of *L. serricorne* and the attacked cocopa bolls has occurred ; moreover the practice of re-planting every year would also be of great value for the control of such pests as *Gasterocercodes gossypii*, Pierce, *D. ruficollis*, *M. peruella* and *Anthonomus vestitus*, Boh.

Günther (O.). **Schädlinge des Rübenbaus in Spanien.** [Pests of Beet in Spain.]—*Anz. Schädlingsk.*, vii, no. 10, pp. 112–116, 4 figs., 8 refs. Berlin, 15th October 1931.

The Halticid, *Chaetocnema tibialis*, Ill., is a serious pest of sugar-beet in Aragon and Catalonia, where it is favoured by the hot, dry summers. All the injury observed was due to the adults feeding on the leaves of the beet ; the eggs and larvae probably occur in the soil. The feeding period lasts for about 7 months, from the beginning of April to the end of September ; young plants are killed, but if the weather is sufficiently cold in the spring, the plants grow large enough to resist infestation before the beetles become active. In older plants the outer leaves are attacked first, and after they have withered or dropped to the ground the inner ones are infested. In cold or windy weather the beetles hide in cracks in the soil and under lumps of earth ; on hot days they congregate on the parts of the leaves that are exposed to the sun. They avoid shade and may soon be driven away if the plants are artificially shaded. In 1930 the beetles first appeared about mid-March, and rapidly increased in numbers in April. Pairing was observed in May, and the first young adults occurred about mid-July. The old beetles had probably disappeared in early September, as no pairing was subsequently observed, but the young ones continued to feed as long as the weather conditions permitted. Hibernation probably takes place under fallen leaves and the débris in beet fields ; in early March 1930 the beetles were present in numbers on the soil in a small pine forest adjoining beet plantations.

As a control measure, sowing as early as the end of February or beginning of March is recommended, in order that the plants may be well grown when infestation begins. Agricultural methods to assist the development of the plants would also be of great value. Proprietary dust insecticides and a spray containing tobacco extract, though effective, are too costly. The cheapest method is to catch the beetles on screens covered with an adhesive that are pushed between the rows on hot and windless days.

Börner (C.). **Mitteilungen über Blattläuse.** [Communications on Aphids.]—*Anz. Schädlingsk.*, vii, no. 10, p. 117, 3 refs. Berlin, 15th October 1931.

In this part of a series of papers [*R.A.E.*, A, xix, 513, etc.] notes are given on *Aphis sambuci*, L., which is common on elder (*Sambucus nigra*) in Germany, except at the height of summer. The summer food-plant was unknown, but the author's experiments have shown that this Aphid can develop on dock (*Rumex obtusifolius* and *R. crispus*). Characters distinguishing it from other Aphids that infest *Rumex* are indicated.

Babel (A.). **Ist der Apfelblütenstecher schädlich ?** [Is the Apple Blossom Weevil injurious?]—*Anz. Schädlingsk.*, vii, no. 10, pp. 117–119, 1 graph, 13 refs. Berlin, 15th October 1931.

The author disagrees with the opinion of other observers in Germany that the apple blossom weevil [*Anthonomus pomorum*, L.] is not injurious [*R.A.E.*, A, xix, 424, etc.], and estimates that it damages 4·6 per cent. of blossoms that would develop into fruit. The conditions for the breeding of the weevil are especially favourable in a year in which the flowering of apples is profuse ; such a year is, how-

ever, always followed by one of decreased or insufficient flowering, and owing to the abundance of the weevils the infestation becomes very severe and the loss of the whole crop may result.

ELLING (M.). **Eine neue Art der Fritfliegen-Bekämpfung.** [A new Method of controlling the Frit Fly.]—*Wbl. landw. Ver. Bayern.* (Abstract in *Anz. Schädlingsk.*, vii, no. 10, pp. 119–120. Berlin, 15th October 1931.)

In a district in Bavaria plots of oats intermixed with barley, in the proportion of 4 : 1, were not attacked by the frit fly [*Oscinella frit*, L.], whereas severe infestation occurred in fields in which oats alone were sown.

STELLWAAG (F.). **Zwiebelschädlinge in der Südpfalz.** [Onion Pests in the southern Palatinate.]—*Winzer u. Bauer*, Beilage z. *Landauer Anzeiger*, 4th July 1931, reprint 1 p. Landau, 1931.

Severe damage to onions near Landau was caused in May and June 1931 by the larvae of *Dizygomyza cepae*, Her., which has previously been recorded only once from Germany. They were accompanied by those of *Phytomyza atricornis*, Mg., and *Drosophila phalerata*, Mg., and sometimes by *Acrolepia assectella*, Zell. No variety of onion proved immune from this Agromyzid, and infested plants harboured as many as 100–200 larvae. As millions of hibernating pupae occurred on the ground in the fields, it is anticipated that another outbreak will take place in 1932. The measures recommended are removal and destruction of infested plants, deep ploughing to bury the pupae, and keeping the soil hard in April and May to prevent the emergence of the adults. Stable manure attracts the flies. Onions should only be grown at a considerable distance from fields where severe infestation has occurred.

BORCHERS (F.) & MAY (E.). **Betrachtungen über die Prüfung u. Normierung arsenhaltiger Pflanzenschutzmittel vom Standpunkte der Praxis aus.** [A Survey of the Tests and Standardisation of arsenical Preparations for the Protection of Plants with regard to their Use in Practice.]—*Z. PflKrankh.*, xli, no. 9, pp. 417–440, 2 figs., 23 refs. Stuttgart, September 1931.

This is a detailed discussion, largely based on the literature, of methods employed to estimate the value of different arsenical insecticides [*R.A.E.*, A, xi, 551 ; xiv, 192 ; xvii, 381, 485 ; xviii, 311, 525]. The authors consider that, as the toxicity of arsenicals of equal chemical composition varies greatly owing to such factors as temperature and light, the addition of inert carriers, and physical properties, it is not possible to use an insecticide as a standard for comparison in experiments on various preparations. This applies also to the use of a standard insect, as the effect of the insecticide largely depends on the stage and age of the insect, the generation [xviii, 523], and individual dissimilarities. Laboratory tests may determine whether a certain preparation is of potential use in the field, but its value in practice can be ascertained only by means of field experiments on a large scale.

In the case of forest pests, plots covering an area of not less than 24 acres should be used and experiments conducted over several years. The effect of the insecticide on the feeding activity of the pest, which is of special importance, can be determined by collecting the excreta of

the larvae [xix, 702]. The dependence of insecticides on external factors is especially evident in controlling orchard pests, and large-scale experiments in orchards would, therefore, be of particular value. Samples are given of forms for reports by fruit-growers on the conditions under which the infested trees were treated and the results obtained.

GLEISBERG (W.) & MENTZEL (F.). **Zur Methode von Raupenleimprüfungen im Freilandversuch.** [On the Method of testing in Field Experiments the Adhesive for catching Caterpillars.]—*Z. Pfl-Krankh.*, xli, no. 10, pp. 481–518, 4 figs., 11 refs. Stuttgart, 1931.

Methods of testing adhesives for banding are discussed from the literature, and an account is given of field tests of 18 German brands carried out in Saxony in 1930–31 against *Cheimatobia brumata*, L. The spreading capacity and viscosity of the various adhesives under field conditions depend partly on temperature, etc., and a special apparatus, which is described, was used for tests of their adhesiveness. By means of this, 50 cabbage seeds are discharged on the band at a regular velocity and from a constant distance, the effectiveness of the band being estimated by the number of seeds that adhere to it.

RIPPER (W.). **Die Blutlauszehrwespe in Welschtirol** (*Aphelinus mali* **Haldem.**). [The Parasite of the Woolly Aphis in Italian Tyrol.]—*Neuheiten Geb. PflSchutzes*, 1931, no. 4, pp. 97–99. Vienna, September 1931.

The woolly aphis [*Eriosoma lanigerum*, Hausm.], which caused severe damage to apple trees near Bolzano (Bozen), has recently been completely eliminated by the Chalcid, *Aphelinus mali*, Hald., which was introduced from Venetia in 1925 and has been successfully distributed by affixing parasitised material to infested trees [*cf. R.A.E.*, A, xii, 94]. It established itself at a considerable distance from Bolzano by flying in numbers across the river Etsch. Though the climate is much more severe than that of Venetia, the parasite is able to withstand the frost. It is, however, susceptible to rain, and parasitised material is therefore being kept under a roof in the open during the winter. Should the weather in spring be too mild and the parasites begin to emerge before the appearance of the Aphids in the field, they should be kept in a cold building. The successful development of *A. mali* greatly depends on the weather, abundant rainfall in April-June being detrimental to it.

THOMSEN (M.). *Tortrix rufimitrana*, **en for Danmark ny aedelgranfjende.** [*Enarmonia rufimitrana*, a new Pest of Silver Fir in Denmark.]—*Dansk. Skovforen. Tidsskr.*, xv, pp. 185–194. Copenhagen, 1930. (Abstract in *Neuheiten Geb. PflSchutzes*, 1931, no. 4, p. 111. Vienna, September 1931.)

Enarmonia (*Tortrix*) *rufimitrana*, H.S., which has not previously been recorded from Denmark as a pest, is recorded as attacking silver fir [*Abies*] in stands 20–30 years old. The biology of this Tortricid and the importance of the infestation are discussed.

BROOKS (A. J.). **Locust Invasions.**—*Ann. Rep. Dept. Agric. Gambia 1930–31*, pp. 5–6. London, 1931.

Swarms of *Locusta migratoria migratorioides*, Rch. & Frm., invaded the Gambia towards the end of November 1929, and a certain amount

of damage was done. Mature crops were immediately reaped, and the immature ones were protected by smoke screens. Further swarms were subsequently reported from each Province. The situation grew serious in June 1930, when germination of the new crop commenced and hoppers from the eggs of these adults appeared in great numbers. Little damage was done, however, owing to co-operative control measures, which included the use of metal barriers and trenches, and few, if any, locusts migrated to neighbouring territory. By the end of the year this species had been entirely destroyed, and it has not been observed since.

Countless numbers of *Schistocerca gregaria*, Forsk. (desert locust) appeared early in January 1931 from Senegal and caused severe damage. In view of the seriousness of the situation, resources for control operations were conserved with a view to making a concerted attack about the time of sowing in May, when the hoppers were expected to appear.

GLOVER (P. M.). **A Practical Manual of Lac Cultivation.**—81 pp., 16 pls., 2 diag., 17 refs. Calcutta, The Indian Lac Association for Research, June 1931.

The author primarily intended this book as an answer to numerous enquiries regarding the cultivation of lac in India, and the major portion deals with the practical details of the entire process; it was later decided that the addition of some important results of research would increase its value. The various observations on the several host trees refer particularly to Bihar and Orissa, but though they may require slight modifications elsewhere, they would also apply to a large percentage of lac-growing districts, excluding Burma and Assam. Some 16 pages are devoted to the insect pests of *Laccifer lacca*, Kerr, and of its host trees, in order to elucidate the control measures suggested [*cf. R.A.E.*, A, xix, 650, etc.]. A dictionary of entomological terms and of those used in lac cultivation is appended.

NEGI (P. S.), MISRA (M. P.) & GUPTA (S. N.). **Some Aspects of the Bionomics of the Lac Insect.**—*J. Bombay Nat. Hist. Soc.*, xxxv, no. 1, pp. 150–155. Bombay, 15th June 1931.

Experiments were undertaken with two Katki crops (July to October–November) and two Baisakhi crops (October–November to July) to test the accuracy of the statement that the first batch of the larvae of lac insects to swarm are mainly female, whereas those appearing later are chiefly male. The authors found this to be incorrect, and there seems to be no interrelation between the sequence of emergence and the sex ratio. The Baisakhi crop is obtained from the females of the Katki crop. In the majority of cases their progeny is predominantly female, in a few cases predominantly male and in some intermediate between the two (cells producing 40–60 per cent. of either sex). The Katki crop is produced by females of the Baisakhi crop. In the majority of cases their progeny is predominantly female, in some cases entirely female, and in a few intermediate.

The length of the swarming period depends on the temperature, the egg-laying capacity of the female and the rate of egg-laying. For individuals emerging from a single mother cell of the Baisakhi crop, the maximum swarming period appears to be 11 days and the average 6; and for those emerging from one of the Katki crop, the maximum appears

to be 16 and the average 7. The maximum swarming from a single cell on one day occurs between the first and fifth day. The maximum egg-laying period is about 14 days with an average of about 7. The largest number of eggs for a single day are laid between the second and sixth days of the oviposition period.

The best brood lac is that in which healthy cells are situated closely but separately on the stick or are coalesced without much overlapping.

Durability of Malayan Timbers. I. Foxworthy (F. W.). **Untreated Timbers; II.** Foxworthy (F. W.) & Woolley (H. W.). **Treated Timbers; III.** Pendlebury (H. M.). **A Note on Termites.**—*Malayan For. Rec.*, no. 8, 60 pp., 6 pls., 5 refs. Kepong, Selangor, 1930. Price 2*s.* 6*d.* [Recd. October 1931.]

Practical tests were undertaken from 1918 to 1928 to determine the relative durability under Malayan conditions of various untreated timbers of both local and foreign origin when buried in trenches 15 or 18 inches deep. The results are recorded, a list being given of the woods that lasted for five years and may therefore be considered durable. No wood was found to be immune from termite attack. Pieces containing sapwood were destroyed more quickly than those composed entirely of heartwood. Hardness of the wood does not prevent attack, *Koompassia malaccensis*, a very hard wood, being sometimes destroyed within six months.

Experiments were carried out from 1923 to 1928 on the effect of treating the surface of wood with preservatives. Some 25 commercial brands were tested, the treated samples being buried in trenches and examined annually. A total of 16 gave perfect protection for a year; these, with one exception, were all of an oily nature. Termites were responsible for most of the damage that occurred. Temporary structures built off the ground have been kept in good order for many years when they have been constantly occupied and inspected at frequent intervals, provided that the posts are set in cement, with a small channel kept filled with a preservative round their bases, and that the undersides of the buildings are given periodical treatments with a preservative.

An account is given of the life-history of termites in general, with a list of 76 of the 81 Malayan species and notes on some of the commonest, *viz.*, *Coptotermes curvignathus*, Holmgr., which has been confused with *C. gestroi*, Wasm., and attacks living rubber trees [*Hevea*], *K. malaccensis*, *Shorea* spp., coconut and kapok; *C. travians*, Hav., and *Calotermes* (*Cryptotermes*) *domesticus*, Hav., occurring in houses; *Rhinotermes* (*Schedorhinotermes*) *malaccensis*, Holmgr., in houses and wooden posts; *R.* (*S.*) *sarawakensis*, Holmgr., which has been recorded in *Ficus elastica*; *Parrhinotermes pygmaeus*, O. John, on rubber estates; and *Eutermes* spp., which often make covered ways on the bark of trees.

Corbett (G. H.). **Entomological Notes. Third Quarter, 1931.**—*Malayan Agric. J.*, xix, no. 10, pp. 496–498. Kuala Lumpur, October 1931.

Coptotermes curvignathus, Holmgr., frequently bores in the trunks of coconut palms, but observations indicate that entrance is only effected by way of the crown or directly through the bole, and where communication with the ground has become established, it has been from within the trunk and not through the base of the palm. This species is well

known as a pest of living rubber [*Hevea*] and has often been assumed to be the only one attacking healthy plants in Malaya, but during the third quarter of 1931 *Rhinotermes ? malaccensis*, Holmgr., was observed working at the base of an oil palm [*Elaeis guineënsis*] in which it had penetrated about 3 inches. The leaves resembled those of palms attacked by " crown disease," but the trunk appeared entirely sound. *Microtermes pallidus*, Hav., has been noticed damaging tea and coffee bushes.

The caterpillars of *Tirathaba* sp. again caused injury to the fruit bunches of oil palm [*R.A.E.*, A, xix, 295]. Infestation of oil palm kernels by *Ephestia cautella*, Wlk, is undoubtedly due to its presence in the old rice-sacks in which they are transported, as is the case with copra [xix, 646]. It is suggested that the sacks should be steamed before use.

With regard to work during 1930–31 on the control of rice-borers by *Trichogramma minutum*, Riley, H. T. Pagden reports that in the colonised area the parasitised egg-masses of *Diatraea auricilia*, Dudg., were collected earlier than in the uncolonised area, and the former yielded a higher percentage of parasitism and a lower percentage of bored stems. The yield of rice was less than in the uncolonised area, but this is thought to have been largely due to greater soil fertility in the latter area. During February *Microbracon hebetor*, Say, appeared in the insectary and reduced the colony of *Sitotroga cerealella*, Ol., *E. cautella* and *Corcyra cephalonica*, Saint., the eggs of which are used for the propagation of *T. minutum*, to such an extent that a new colony had to be established.

To prevent the spread of the coffee berry borer [*Stephanoderes hampei*, Ferr.] to areas at present uninfested, no further supplies of coffee seed should be introduced, and where new areas are to be planted the immersion of the seeds in boiling water is advisable. This Scolytid has not so far been found on several wild species of coffee that occur in Malaya.

DE JONG (J. K.). **Verslag van den entomoloog. (Jaarverslag van het Algemeen Proefstation voor Thee, 1930.).** [Entomologist's Report. Report for 1930 of the Tea Experiment Station, Buitenzorg.]—*Arch. Theecult. Ned.-Ind.*, v, no. 4, pp. 176–178. Buitenzorg, September 1931.

Some of the information given here has appeared in two papers already noticed [*R.A.E.*, A, xix, 517]. To ascertain if the composition of the sap in the cells in the leaves of tea influences *Helopeltis*, twigs bearing this bug were stood in various specified chemical solutions without apparent result.

Lophococcus convexus, Morr., was a serious pest of cacao on one plantation. The natural enemies of this Coccid included three species of predacious Lepidoptera.

TURNER (A. J.). **Revision of Australian Lepidoptera. Supplementary.** —*Proc. Linn. Soc. N.S.W.*, lvi, pt. 4, pp. 325–344. Sydney, 15th October 1931.

Among the species described is the Pyralid, *Creobota coccophthora*, gen. et sp. n., reared from larvae attacking *Eriococcus* sp. near Canberra. The caterpillar makes a very loose and flexible cocoon round itself

without leaving any definite opening, and feeds by thrusting its head anywhere through the rather loose walls. The outside of the cocoon is sticky so that it adheres well to the twigs among the scale-insects. The larva moves by walking inside this cocoon, which rolls round its body.

MUGGERIDGE (J.). **Entomology Section.**—*Ann. Rep. Dept. Agric. N.Z. 1930–31*, p. 46. Wellington, N.Z., 1931.

Some of the work on insect pests in New Zealand in 1930–31 has already been noticed [*R.A.E.*, A, xix, 81, 141, 447]. No individuals of *Encarsia formosa*, Gah., a parasite of *Trialeurodes vaporariorum*, Westw., emerged from a consignment received from England through the Imperial Institute of Entomology, but it is hoped to obtain further supplies. Lead arsenate used at the rate of 2 lb. to 100 sq. ft. of surface showed promise against *Odontria zealandica*, White, on lawns.

ESAKI (T.) & TAKEYA (C.). **Identification of a Japanese Tingitid injurious to the Pear-tree.** [*In Japanese.*]—*Mushi* (*J. Fukuoka Ent. Soc.*), iv, pp. 51–59, 3 pls., 2 figs. Fukuoka, Japan, November 1931.

Stephanitis nashi, sp. n., which is described in English, is recorded from Japan and Korea on pear, peach, plum, cherry, apple, *Cornus* and *Crataegus*.

JAYNES (H. A.). *Acrotomopus atropunctellus* **Boh. in Argentina Sugar-cane.**—*Ann. Ent. Soc. Amer.*, xxiv, no. 3, pp. 554–560, 1 pl., 3 refs. Columbus, Ohio, September 1931.

The Curculionid, *Acrotomopus atropunctellus*, Boh., the original description of which is quoted, has recently been discovered in sugar-cane shoots in the Province of Jujuy and in Tucumán, Argentina, and investigations indicate that it is generally distributed throughout the cane-growing districts though damage by it appears to be local. The eggs, which have very rarely been found, were deposited in small, tender shoots of cane that had turned slightly brown with punctures in three or four places. There is only one generation annually, and larvae occur within the cane throughout the year. A larva frequently bores down one shoot and up another, and sometimes the centre of the stool is largely consumed. Two larvae may attack the same shoot, but one usually destroys the other. The larva passes the winter in the lower portion of the shoot, going 2 or 3 inches below the surface of the ground, but before pupation it bores a tunnel to the outside of the cane, through which the adult can escape. In the laboratory the pupal stage occupied 7–14 days. Rearing records indicate that the weevils probably appear in the field by the middle of November, though they have not been observed before early December. They drop to the ground when disturbed, or hide between the leaf sheath and stalk. They kill many of the young cane shoots by puncturing them for food ; this injury especially attracts attention early in the season, in the first part of December, when the punctured side shoots turn brown and die ; later they fall among the trash and are not noticed. In one locality, 12·6 per cent. of the weevil larvae were found to be parasitised by the Dexiid, *Paratheresia claripalpis*, Wulp, which also infests *Diatraea saccharalis*, F., in both Argentina and Peru.

WALTERS (E. A.). **Control of Insect Pests.**—*Rep. Agric. Dept. St. Lucia 1930*, p. 5. Trinidad, 1931.

There was no marked dry season in St. Lucia during 1930, rain falling throughout the first four months, and as a result there was a general absence of severe infestation of scale insects and an increase of entomophagous fungi, particularly on the citrus snow scale [*Prontaspis citri*, Comst.] and on *Coccus viridis*, Green, on mangos. The chaffy brown scale [? *Parlatoria pergandei*, Comst.], which, owing to its being inconspicuous, is generally more destructive than is realised, caused die-back of planted budded *Citrus* trees. No serious increase of the areas infested by the weevil, *Polyderces zonatus*, Swed., which destroys the leaf stalks of coconut, has apparently taken place. *Leucoptera coffeella*, Guér. (coffee leaf miner), the larvae of which mine the leaves of *Coffea arabica*, *C. robusta* and *C. liberica*, was fairly common in one district.

SPENCER (G. J.). **An important Breeding Place of Clothes Moths in Homes.**—*Canad. Ent.*, lxiii, no. 9, pp. 199–200. Orillia, Ont., September 1931.

On examination of the rectangular shafts of the hot-air heating system in the basement of a house in Vancouver, British Columbia, deposits of woollen fluff were found where the vertical shafts joined the horizontal ones leading to the furnace. These pads, which were present whether the opening of the pipe was situated on the floor or in the wall of the room, were infested with *Tineola biselliella*, Humm., and *Tinea pellionella*, L. In an experiment it was found that in four months, during which time probably less than one-fourth the total sweepings from a small rug and the floor of a much used room had been pushed down a cold air shaft, a sufficient deposit had occurred to attract the moths.

MILLER (J. M.). **High and low lethal Temperatures for the Western Pine Beetle.**—*J. Agric. Res.*, xliii, no. 4, pp. 303–321, 3 figs., 9 refs. Washington, D.C., 15th August 1931.

An account is given of investigations conducted during 1920–29, in California, Oregon and Idaho, on the part played by temperature in natural and artificial control of the immature stages of *Dendroctonus brevicomis*, Lec., in the bark of yellow pine [*Pinus ponderosa*] much of the information on the effect of high temperatures that result from solar heat being similar to that already noticed in the case of observations on *D. monticolae*, Hopk. [*R.A.E.*, A, xviii, 642].

The following is taken from the author's summary: Temperatures affecting stages of the beetle in the bark must reach them through the protective covering of the outer bark. Critical environmental temperatures must therefore occur in the outer bark. As regards the effect of heat, larvae removed and exposed to warm air under conditions that retard evaporation die at about the same points of temperature as in the bark. If rapid evaporation is permitted, paralysis and mortality occur at temperatures of about 5° F. lower than those at which they occur in the bark.

Low temperatures that result in the death of the broods from freezing may materially reduce the beetle population in infested areas. Mortality of the larvae follows freezing when bark temperatures are lowered below 0° F. Partial mortality occurs at zero in broods that

overwinter in the yellow pine belt of the Sierra Nevada region; mortality at −5° exceeds 60 per cent., and practically no larvae survive at −10°. Temperatures within the range of 0° to −10° are consistently critical, regardless of the rate at which the temperature of the bark is lowered or warmed back from below zero to normal temperatures; complete mortality develops within this range regardless of whether the larvae are actively developing or dormant when the bark temperature is lowered to the critical points. Mortality of the pupae is high between 5° and −5° and complete at −8°; that of the adults is high between 12° and 5° and nearly complete at 0°. The results of investigations on the effect of temperatures on the eggs, although somewhat inconclusive, indicate that they are much more resistant to cold than the other stages of the beetle. Destruction of the eggs was partial between 5° and −10°, and at −15° amounted to about 90 per cent.

When the larvae become dormant through saturation of the bark with water, they are less resistant to cold, and about 20 per cent. die at 10° F. Complete mortality, however, does not occur until points between −5° and −10° are reached. When larvae are removed from the bark and exposed to cold air, complete mortality occurs at between 5° and −8°. The point at which the larvae freeze but recover if warmed occurs between 10° and 15°. Larvae become dormant at about 40–45° and show no further change until the freezing point is reached. Normal activity of the larvae occurs at temperatures between 55 and 90°. Broods that overwinter in regions where the minimum winter temperatures are below 0° apparently develop greater resistance to cold than in regions with mild winter climates. In an area where an air temperature of −10° had been reported, mortality among the larvae was high when the bark temperature was reduced from 0° to −10°. About 25 per cent., however, survived a temperature of −10°. Mortality was practically complete at −18°. The range in low temperatures that are withstood, owing to the influence of regional conditions, apparently does not exceed 10°. Records during two periods when the temperature was below zero show that the minimum bark temperatures are 10–12° higher that the minimum air temperatures.

BURRELL (R. W.). *Dexia ventralis* **Aldrich, an imported Parasite of the Japanese Beetle.**—*J. Agric. Res.*, xliii, no. 4, pp. 323–336, 7 figs., 3 refs. Washington, D.C., 15th August 1931.

An account is given of the work on the breeding and establishment of *Dexia ventralis*, Aldr., which was introduced from Korea into the United States for the control of *Popillia japonica*, Newm. (Japanese beetle) [*cf. R.A.E.*, A, xv, 298, 443; xvii, 176]. The laboratory technique and method of transporting the parasites are discussed. They are shipped as larvae within the host larvae, emergence and pupation usually occurring in transit. About 85 per cent. of those received in 1927 produced adults. Mating was successfully achieved by placing the flies in an outdoor cage 8 ft. square by 6 ft. high, the top of which was covered with white muslin and the sides with black mosquito netting. With a population of 70–100 flies and a sex ratio of 2 or 3 males to 1 female, on an average 60 per cent. of the females were found to be fertile. The results of attempts to breed the parasites were unsatisfactory, and further experiments are necessary. Four colonies have been released, and one is apparently established. Two

generations of the flies occur during the year in the United States, the winter being passed as a larva within the host. The parasite will attack and develop in any larval instar of its host, although the third instar is preferred. Attempts to induce it to parasitise a number of native Lamellicorn beetles were unsuccessful.

ENGELHARDT (G. P.). **Blueberries as Carriers of the Japanese Beetle.** —*Bull. Brooklyn Ent. Soc.*, xxvi, no. 3, p. 134. Brooklyn, N.Y., 1931.

Two adults of *Popillia japonica*, Newm. (Japanese beetle) were found in a small box of blueberries sent from New Jersey to a district in New York State in which it has not yet become established.

DE LONG (D. M.) & DAVIDSON (R. H.). **The Genus *Agallia*—External Characters used to distinguish the Species injuring economic Crops.**—*Ohio J. Sci.*, xxxi, no. 5, pp. 377–385, 1 fig., 1 pl., 3 refs. Columbus, Ohio, September 1931.

Brief descriptions are given of the eleven species of *Agallia* that occur on cultivated plants in the United States, with a key and notes on their distribution. *A. sanguinolenta*, Prov., which is the most widespread and abundant, attacks a wide range of plants and has been recorded in large numbers on clover, lucerne, potato, sugar-beet, beans, and a number of other field crops.

HOTTES (F. C.) & FRISON (T. H.). **The Plant Lice, or Aphiidae, of Illinois.**—*Bull. Illinois Nat. Hist. Surv.*, xix, art. 3, pp. 121–447, 10 pls., 50 figs., 14 pp. refs. Urbana, Ill., September 1931.

This important paper is a faunistic or synoptic study of the Aphids of Illinois; it is not regarded by the authors as revisional or monographic, though references to original descriptions of species and others necessary because of the introduction of new synonymy are cited. Brief notes are given on the structure of Aphids, their life-histories, life-cycles and distribution, and the collection and preservation of material, and a section, prepared by W. P. Flint, on control, particularly by means of nicotine, is included. Keys, prepared almost entirely on the basis of alate viviparous females, are given to the subfamilies, tribes, genera and species, as well as to the species occurring on cultivated plants, grouped according to the latter. An alphabetical list of the food-plants is appended, with the Aphids that occur on them.

Two new genera and 39 new species are described, the latter including *Aphis chetansapa* on *Pyrus* sp. and *Prunus* sp.; *A. decepta* on parsnip (*Pastinaca sativa*); *Drepanaphis keshenae*, which also occurs in Wisconsin, on *Acer saccharum*, and *Callipterus* (*Monellia*) *nigropunctata*, which is widely distributed in the eastern United States, on walnuts (*Juglans* spp.), hickory and pecan (the two last-named are described by Granovsky); *Eriosoma mimica* on *Ulmus fulva*; and *Myzus thomasi* on *Ribes* sp. A new subgenus, *Kakimia*, is erected for the last species and also includes *M. houghtonensis*, Troop, and *M. heucherae*, Thomas.

Siphonophora euphorbiae, Thomas, and *S. euphorbicola*, Thomas, are considered to be synonyms of *Macrosiphum gei*, Koch; *Myzus*

fragariae, Theo., of *Capitophorus fragaefolii*, Ckll.; *Aphis lutescens*, Monell, of *A. nerii*, Boy.; and *Georgiaphis gillettei*, Maxs. & Hott., of *G. ulmi*, Wilson.

Hill (C. C.) & Smith (H. D.). **Seasonal History and morphological Notes on** *Polyscelis modestus* **Gahan.**—*Proc. Ent. Soc. Wash.*, xxxiii, no. 7, pp. 182–185, 1 pl., 1 ref. Washington, D.C., October 1931.

The Pteromalid, *Polyscelis modestus*, Gahan, which was thought to be a rare parasite of the hessian fly [*Mayetiola destructor*, Say] [*R.A.E.*, A, xiii, 183], was found in the spring of 1928 in considerable numbers in two heavily infested wheat fields in Pennsylvania. The eggs are laid indiscriminately in puparia containing larvae or pupae, which apparently have been previously paralysed.

Smith (R. C.). **A Study of Temperature and Humidity Conditions in common Types of Insect Rearing Cages.**—*J. Agric. Res.*, xliii, no. 6, pp. 547–557, 2 figs., 7 refs. Washington, D.C., 15th September 1931.

Observations in the course of insect rearing experiments showed that a hygrothermograph set near the cages indicated very closely the temperatures to which the insects were being subjected, the cage temperatures averaging 1·38–1·96° F. lower than the hygrothermograph. It did not, however, indicate the relative humidity, which was from 12 to 60 per cent. higher in the smaller and more tightly closed cages than in the open, transpiration of healthy growing plants and evaporation from the surface of the soil tending slightly to depress the temperature and markedly to increase the humidity in cages. The temperatures tended to equalise when the plants became unthrifty and died. The more tightly a rearing cage was closed, the higher the humidity became; two thicknesses of cheesecloth closed a lamp-chimney cage tightly enough to produce frequently a saturated atmosphere. The very slight loss of water from the atmometers in cages of the salve-box and jelly-glass types indicated that the air within must have been almost completely saturated for most of the time. Cheesecloth-covered wire-screen cages gave a lower evaporation rate than cages of wire screen alone, indicating higher humidity within. Glass cages such as inverted battery jars showed markedly higher temperatures when set in the sun than when set in the shaded insectary; the humidity at the same time rapidly approached the dew point and conditions became too moist for most rearings. It is evident therefore that salve boxes and jelly glasses are unsuitable for general rearings; bacteria and fungi frequently form in the conditions of high temperature and humidity, and the presence of moist sand or soil aggravates the situation. The temperature and humidity in all the cages were also clearly affected by weather conditions. The dew-point apparatus proved valuable and reliable for the determination of the humidity in cages and can be used in small cages if they are transparent, but is subject to large variations because of the difficulties involved in observing the film of moisture on the cup. Alternative kinds of apparatus for use in small cages are discussed.

Swingle (H. S.) & Snapp (O. I.). **Petroleum Oils and Oil Emulsions as Insecticides, and their Use against the San José Scale on Peach Trees in the South.**—*Tech. Bull. U.S. Dept. Agric.*, no. 253, 48 pp., 2 pls., 126 refs. Washington, D.C., July 1931.

The origin, principal constituents and chemical and physical properties of crude petroleum oils are discussed ; the methods used in the production of lubricating oils from them are explained, and the composition and properties of the latter are indicated. Cottonseed oil proved as effective as fish-oil for making a soap emulsifier, and red oil (oleic acid) made a good cold-stirred soap ; the saponification numbers of various oils tested are given. The principles involved in the manufacture of various types of emulsions and miscible oils are discussed, and the advantages of each are pointed out. The quality of a cold-stirred emulsion was greatly influenced by the viscosity of the soap and also by the moisture content, the kind and quantity of caustic used and the temperature, the best emulsion being obtained with a soap having only a slight excess of caustic potash and a moisture content of from 60 to 75 per cent. Butyl alcohol proved almost as good a stabiliser for these emulsions as amyl alcohol or cresylic acid. Old casein-lime mixtures that failed to emulsify oils could be made to do so by the addition of fresh hydrated lime. The freezing points of the commoner emulsions ranged between 29·7 and 31·8° F. ; they could, however, be undercooled for short periods to 17 or 18° F. before freezing began if undisturbed. If stirred while either freezing or thawing, the emulsions broke down, but if left undisturbed they almost always thawed without breaking.

Previous work on the effect of mineral oils on insects is reviewed, the indications being that in the case of Coccids death is due to suffocation. The methods used by various workers in testing the toxicity of oil sprays in the field against San José scale [*Aspidiotus perniciosus*, Comst.] are described. Viscosity, density, volatility and the degree of refining, as measured by the sulphonation test, are discussed as influencing toxicity. In field tests, viscosity seemed to be the best indication of toxicity of dormant sprays. The best results in the southern United States were obtained with a mineral oil having a viscosity (Saybolt at 100° F.) of not less than 125 seconds and a volatility (loss for 4 hrs. at 105° C.) of not more than 1·75 per cent. The unsulphonated residue, the nature of the base of the crude oil, and the flash and fire points were apparently without effect upon toxicity. Over a four-year period the average percentages of control of San José scale were 91 with 1 per cent. oil, 96·9 with 1½ per cent., 96·1 with 2 per cent., and 99·1 with 3 per cent. ; only the last is recommended for commercial use. Rain after the water in the oil spray on the trees has evaporated does not affect the toxicity of the spray. At 2 per cent. strength, the more unstable emulsions were found to be slightly more toxic than the more permanent ones.

The effect of mineral oils on plants is discussed. Sprays containing 25 per cent. or more of oil injured dormant peach trees ; lower concentrations had no effect. A high percentage of unsulphonated residue indicates that the oil is safer for use on peach trees in foliage than an oil with a low residue. Oil sprays neither retarded nor advanced the blossoming period of peaches, and no evidence of cumulative injury could be detected from yearly applications of oil sprays. Three weekly applications of a 6 per cent. oil spray could be made upon one-

year-old dormant peach trees, and older trees could stand even more applications. No differences could be detected in the covering power of lime-sulphur, oil emulsion and miscible oil sprays under orchard conditions; none between oil emulsions having soap and casein-lime as emulsifiers; and none between oil sprays containing 2 and 3 per cent. of oil.

SPULER (A.). **Effect of Overhead Sprinklers on Insects and their Control.**—*Proc. Washington St. Hort. Ass.*, xxvi (1930), pp. 54–56, 2 figs. [Olympia, Wash., 1931.]

Experiments were carried out to determine the effect of the overhead sprinkling system of irrigation on control of the codling moth [*Cydia pomonella*, L.]. Various arsenical sprays were used on different plots in an orchard, and sprinkling was done in each case just prior to spraying. The results showed that an average of 29 per cent. of the lead arsenate was removed with each sprinkling, and the reduction in arsenate deposit was reflected in poorer control of the moth. With regard to the effect on other insects, eight orchards under the sprinkler system were observed throughout the season, and only in the case of various mites was there any reduction in numbers.

SPULER (A.) & others. **Value of Combinations with Lead Arsenate and Summer Oils in Codling Moth Control.**—*Proc. Washington St. Hort. Ass.*, xxvi (1930), pp. 59–72, 8 diag. [Olympia, Wash., 1931.]

The control of the codling moth [*Cydia pomonella*, L.] in the Pacific Northwest is becoming an increasingly difficult problem owing to the increased production of fruit and the acquired resistance of the insect to lead arsenate. Insectary tests in two years show that approximately 45 per cent. of newly hatched larvae placed on apples sprayed with lead arsenate (2 lb. to 100 U.S. gals.) will enter the fruit unpoisoned. The amount of deposit obtained from the use of various brands of lead arsenate is discussed, and the results of adding lime, a commercial spreader, fish oil and mineral oil to lead arsenate are shown by means of diagrams (2 lb. per 100 U.S. gals. were used with the oils and 3 lb. in the other sprays). Lead arsenate alone gave a greater deposit than when combined with any material except fish-oil, but was the least effective; lime invariably reduced the deposit and did not produce film coverage at the strength used (½ lb. to 100 U.S. gals.), but very slightly increased the control. The commercial spreader especially designed to produce a film coverage without appreciably reducing the arsenical deposit proved superior to the calcium caseinate spreaders previously used. The addition of this spreader to those brands of lead arsenate containing a deflocculator improved the spray materially, but it had only a slight value when used with brands containing no deflocculator. Lead arsenate used at 2 lb. per 100 U.S. gals. with the addition of one U.S. qt. of fish-oil gave greater arsenical deposit than when used at the rate of 3 lb. without fish-oil. The use of ½ U.S. pint only of the oil did not reduce deposit but gave poorer coverage, and the larger amount will undoubtedly give better results as an ovicide. In the insectary, one quart of fish-oil per 100 gals. killed approximately 60 per cent. of the eggs. In connection with the highly refined oils now used for summer sprays, the most significant factor in their success

seems to be the emulsifier. The flocculation of lead arsenate particles that frequently occurs is apparently the result of a partial breaking of the oil emulsion. This can be overcome by selecting one which does not produce flocculation, or by choosing a lead arsenate with a deflocculator, or by adding a small amount of either lime or spreader ($\frac{1}{2}$ lb. per 100 U.S. gals.) to the oil and lead arsenate mixture. A flocculated mixture will probably cause a serious cleaning problem if allowed to stand in the spray pipes. Insectary tests indicate no significant differences from the point of view of codling moth control in the various summer oil emulsions tested, though a stable emulsion will produce the highest deposit of lead arsenate. The use of certain proprietary brands of lead arsenate and of oil with regard to scorching of the foliage is discussed.

A series of spray programmes was tested. The best results were obtained from the following materials per 100 U.S. gals. : a calyx spray of 3 lb. lead arsenate, a first cover spray of 1 U.S. gal. oil with 2 lb. lead arsenate, a second and third cover spray of fish-oil with 2 lb. lead arsenate, a fourth cover spray identical with the calyx spray, and a fifth and sixth cover spray of 1 U.S. gal. oil and $\frac{1}{2}$ U.S. pt. nicotine. The foliage in this case showed practically no scorching and was free from injury by leafhoppers or mites. The residue was ·061 as compared with ·078 in the plot treated with lead arsenate only. The relations of leaf injury to size of the fruit is discussed, and the results of observations are shown in diagrams. A reduction in the size of the fruit occurred if the leaf area was reduced at any time during the growing season, and all materials likely to cause leaf injury should therefore be avoided.

Yothers (M. A.). **The Tarnished Plant Bug.**—*Proc. Washington St. Hort. Ass.*, xxvi (1930), pp. 79–84. [Olympia, Wash., 1931.]

In spite of various control measures the tarnished plant bug [*Lygus pratensis*, L.] continues to be the cause of heavy losses on apples, pears and peaches in Washington, sometimes amounting to the total value of the crop. A summary is given of general information on the pest taken from the literature, with a description of the stages and the type of injury caused, and a review of control measures. There are several generations in a season, and the chief injury is due to the fact that the bugs emerge from hibernation very early in the spring, before there is any food available except the fruit-tree buds. They puncture the buds, blossoms, fruits and growing tips, injuring the pistils and causing the fruit to drop. Buds in an infested cluster that are not killed are frequently stuck together with exudations from the injured ones and drop with them.

Baker (W. S.). **Holly Insects.**—*Proc. Washington St. Hort. Ass.*, xxvi (1930), pp. 183–184, 4 refs. [Olympia, Wash., 1931.]

Of the insects that injure holly in Washington State and sometimes detract from the appearance of the foliage, by far the most important is *Rhopobota naevana* var. *ilicifoliana*, Kearfott (holly bud moth), the larvae of which work on the buds and terminal growth inside a web, which protects them from ordinary sprays. A pressure spray of 1 oz. 40 per cent. nicotine sulphate, 4 oz. fish-oil soap and 3 oz. lead arsenate to 3 U.S. gals. water is recommended, with perhaps a second

application a week later. The rubbish beneath the trees should be collected and burnt before the moths emerge and begin oviposition. This variety is doubtfully distinct from the typical *R. naevana*, Hb., occurring on cranberry, but on holly there is only one generation a year, whereas on cranberry there are three. The holly leaf-miner, *Phytomyza* sp., is generally rather abundant ; it is suggested that the fly may be attracted to a bait spray of 2 U.S. qts. molasses, ½ oz. sodium arsenate and 1 U.S. gal. water, sprayed on the opening buds. Against a Coccid, very similar to *Coccus hesperidum*, L., which is rather numerous, it is thought that 2 or 3 gals. of Volck light oil to 100 gals. of spray, applied while the young are active and crawling, might give good results ; this has already proved fairly effective against the bud-moth and showed no injury to the foliage. At least one species of Aphid occurs on holly, distorting the growth and gumming up the leaves, especially of the terminal shoots. A nicotine sulphate spray should give efficient control. The root weevil, *Sciopithes obscurus*, Horn, makes holes in the leaves, and on one tree two large colonies of *Malacosoma disstria*, Hb., were observed devouring the hard tissue of the leaves.

Hanson (A. J.). **The Redberry Disease of Blackberries.**—*Proc. Washington St. Hort. Ass.*, xxvi (1930), pp. 199–201. [Olympia, Wash., 1931.]

In most of the important blackberry-growing districts of Washington State, much damage is caused by the mite, *Eriophyes essigi*, Hassan, which causes the condition known as the redberry disease of blackberries and in time will undoubtedly become the most serious pest of this crop. Notes on the injury caused and the methods of controlling the mite have been noticed in a paper in which it was erroneously referred to as *E. gracilis*, Nal. [*R.A.E.*, A, xiv, 247]. In Washington, the mites were found throughout September, October and November between the drupelets of the berries, which remained red, gradually faded and dried up. They then moved to the cane buds that would bear the next year's crop, and were found between the compound leaf and the axial bud, but not inside the bud as is the case with some species of *Eriophyes*. The mites are active throughout the winter, but no eggs or younger stages are present. In the spring, when growth of the plant begins, migration to the flowers and other parts of the canes is observed, and at this time probably the mites become widely distributed by insects and other agencies. As the wild blackberries, which supply a large percentage of the canning fruit, become increasingly infested, growers may find a better demand for the cultivated fruit.

Baker (W. S.). **Insect Pests of Sour Cherries and Berries.**—*Proc. Washington St. Hort. Ass.*, xxvi (1930), pp. 207–212. [Olympia, Wash., 1931.]

Popular notes are given on some of the pests of sour cherries and raspberries occurring in Washington State. The most important insect attacking cherry is the fruit-fly [*Rhagoletis*], but whether only one or both the species occurring in the United States [*R. cingulata*, Lw., and *R. fausta*, O.S.] are concerned is uncertain. *Cydia* (*Grapholitha*) *packardi*, Zell. (cherry fruit worm) is an important pest in British Columbia [*R.A.E.*, A, xviii, 343] and is possibly present in

Washington. Pests of raspberries include *Byturus unicolor*, Say, *Pennisetia* (*Bembecia*) *marginata*, Harr., *Phorbia rubivora*, Coq., and various weevils, such as *Dyslobus decoratus*, Lec. About 70 pests have been observed in strawberry fields, all of which are probably more or less injurious to the plants ; the more important of these are enumerated, and the injury due to mites is also discussed.

Smith (H. S.) & Compere (H.). **Introduced Parasites successfully control the Citrophilus Mealybug.**— *J. Econ. Ent.*, xxiv, no. 5, pp. 942–945, 2 refs. Geneva, N.Y., October 1931.

Pseudococcus gahani, Green (citrophilus mealybug), which was accidently introduced from Australia into California, where it has been a major pest of *Citrus* for several years, has been kept moderately under control by the propagation and distribution of *Cryptolaemus montrouzieri*, Muls. [*cf. R.A.E.*, A, xix, 494]. As certain infestations, however, failed to respond satisfactorily to this method of biological control, an attempt was made to discover other insect enemies of *P. gahani* in Australia. The introduction of two of the parasites found there, *Coccophagus gurneyi*, Comp., and *Tetracnemus pretiosus*, Timb. [xviii, 77], has resulted in perfect control of the mealybug. Its absence after liberation of these parasites in 1930 might have been attributable to the extremely hot summer, but the continued absence of infestations in 1931 under normal climatic conditions indicate that the parasites were responsible for control. Of the numerous species of predators liberated, *Midus pygmaeus*, Blackb., and *Chrysopa ramburi*, Schneider, have not been recently recovered in the field, although it is likely that the former is established ; and nothing has been seen for some months of *Diplosis* sp., which was recovered abundantly two years after colonisation. None of the predatory species has given any indication of being of practical value in the control of *P. gahani*.

Swezey (O. H.). **Some recent Parasite Introductions in Hawaii.**— *J. Econ. Ent.*, xxiv, no. 5, pp. 945–947. Geneva, N.Y., October 1931.

Among beneficial insects recently introduced into Hawaii, an egg parasite, *Trichogramma japonicum*, Ashm., from Japan and two larval parasites, *Amyosoma chilonis*, Vier, and *Angitia* (*Dioctes*) *chilonis*, Cush., from China, which were imported in 1928, have become established and have brought about a fairly satisfactory control of *Chilo simplex*, Butl., which caused great injury to rice in the chief rice-growing islands in 1928 [*cf. R.A.E.*, A, xvii, 194 ; xix, 11]. An unidentified Hemerobiid, introduced from Mexico in 1929 against *Pseudococcus brevipes*, Ckll. (pineapple mealybug) has been recovered in pineapple fields, and an internal parasite, possibly an Encyrtid of the genus *Aenasius*, has been recovered from *Ferrisiana* (*P.*) *virgata*, Ckll. *P.* (*Trionymus*) *boninsis*, Kuwana (grey sugar-cane mealybug) appears to be satisfactorily controlled in Hawaii by *Pseudococcobius terryi*, Fullaway [*cf.* xvii, 73]. An undescribed species of *Anagyrus*, parasitic on *Trionymus sacchari*, Ckll. (pink sugar-cane mealybug) in the Philippines was introduced in 1930 and has been recovered from two regions breeding on *T. sacchari* in Hawaii. It is being reared and distributed throughout the sugar-cane plantations of the islands.

Two species of *Scymnus* (*Pullus*), one, which was unidentified, introduced from the Philippines in 1930, and the other, *S. apiciflavus*, Motsch., introduced from the Federated Malay States in 1931, have been distributed as predators on *T. sacchari*, but are not yet known to be established. Two undescribed species of *Scelio*, parasitic on the eggs of *Oxya velox*, F. (*chinensis*, Thunb.) were introduced in 1930–31 from the Federated Malay States, but no recoveries have yet been made.

Mote (D. C.). **The Introduction of the Tachinid Parasites of the European Earwig in Oregon.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 948–956. Geneva, N.Y., October 1931.

The European Tachinids, *Digonochaeta setipennis*, Fall., and *Rhacodineura antiqua*, Mg., the larvae of which live as internal parasites of *Forficula auricularia*, L. [*cf. R.A.E.*, A, xvi, 587], were first introduced into Oregon from France and England in December 1924. A brief account is given of the organisation and administration of the project, together with a summary of the introductions, results of the production of parasites in captivity, their colonisation and present status. An insectary technique has been developed that facilitates the production of several thousand flies each year, the total of *Digonochaeta* produced in 1930 being 4,500 and that for 1931 estimated at over 27,000. It was found to be established in 1930. Work with *Rhacodineura* was discontinued after the severe winter of 1927–28 during which the stock of earwigs parasitised by it was destroyed.

Mote (D. C.), Stearns (H. C.) & Dimick (R. E.). **The Biology of *Digonichaeta setipennis* Fall., a Tachinid Parasite of the European Earwig, as observed primarily under western Oregon Conditions.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 957–961, 2 refs. Geneva, N.Y., October 1931.

Studies of the biology of *Digonochaeta setipennis*, Fall., the most important parasite of *Forficula auricularia*, L., carried out from 1925 to 1931, show that under conditions prevailing in western Oregon adults emerge from the overwintering puparia in some years between the end of April and middle of July and in others between early May and early August. In the first part of the emergence period males predominate, the proportions of the sexes being gradually readjusted until at the end of the period practically all the flies that emerge are females. Eggs are deposited, in close proximity to the host, about 18 days after mating, which occurs immediately after emergence. During 1929, 1930 and 1931 mating was not observed to take place below a temperature of 52° F. and was most common among adults of the first brood between 56 and 80° F. Matings among adults of the second brood were most frequent when the temperature was above 85° F. It was determined by experiment that the odour of *F. auricularia* is probably the main stimulus that causes *D. setipennis* to oviposit. Oviposition extends over a period of 3–5 days, the majority of the eggs being laid on the first and second. A female deposits an average of 250 eggs.

The first stage larva hatches immediately after oviposition and crawls about in search of the host, in the body of which the three

subsequent larval stages are passed. Tests showed that larvae placed on fresh vegetation would remain alive without boring into the host for 36·1 hours and those placed on glass for 27·6 hours on an average. The conditions of larval feeding are described from the results of dissections. Earwigs having served as hosts generally die within a few days of the emergence of the parasite larva during relatively warm weather, but frequently live for a much longer period if the temperature is low. None of the parasitised earwigs under observation recovered from parasitism or fed after the emergence of the parasite. The length of the larval period within the host is quite variable, lasting from 21 to 90 days. If the hosts are small or superparasitism occurs, the larvae develop in a shorter time.

Some of the larvae entering the hosts early in the season complete their development by late June, July or early August, the pupal period lasting 15–40 days, and a partial second brood of adults emerges in the latter part of July to mid-September. The larvae from these adults complete their development between September and the end of November, emerge from their hosts and pupate. Puparia of *D. setipennis* require very little moisture. In the second brood of adults there is no preponderance of males or females in different parts of the emergence period.

Dimick (R. E.). **Hand-parasitizing the European Earwig with the Larvae of** *Digonichaeta setipennis* **Fall.**— *J. Econ. Ent.*, xxiv, no. 5, pp. 962–964. Geneva, N.Y., October 1931.

The following is substantially the author's abstract: A method of parasitising the European earwig [*Forficula auricularia*, L.] with *Digonochaeta setipennis*, Fall., by hand is described. This consists in placing the parasitic larvae on earwigs which are held by a clip or anaesthetised by chloroform.

Larson (A. O.) & Hinman (F. G.). **Some Hibernation Habits of the Pea Weevil in Relation to its Control.**— *J. Econ. Ent.*, xxiv, no. 5, pp. 965–968, 2 pls., 2 refs. Geneva, N.Y., October 1931.

Observations of *Bruchus pisorum*, L. (*pisi*, L.) carried out in view of the suggestion that the real source of infestation may be other than the seed [*R.A.E.*, A, xviii, 483] showed a marked increase in infestations of isolated farms where only fumigated seed was planted and the entire crop was fumigated immediately after harvest. Adults emerging from the shattered peas left on the ground have been found hibernating in previously unrecorded places, such as moss, liverworts and lichens attached to the trunks and branches of trees. *Usnea plicata*, a long greyish-green lichen very abundant on trees in the Willamette Valley, Oregon, is a favoured place of hibernation, the beetles being more numerous at a height of 25 ft. than nearer the ground. Observations showed that Bruchids in peas on the warm ground completed their development and came out to seek hibernation quarters long before most of those remaining in stored peas were fully developed. Where pods had not been harvested, the Bruchids remained in the peas within them long after they had emerged from peas on the ground near by. A search of hibernating quarters in and near fields in which

the stubble had been burned over immediately after harvest [xix, 579] indicated that early burning was an effective control measure.

It is concluded that the presence or absence of suitable hibernating quarters may be a determining factor in the amount of infestation by *B. pisorum* in different isolated pea fields. It nevertheless appears impossible to control it by the elimination of its hibernating quarters, as these seem too numerous and varied.

Webster (R. L.) & Spuler (A.). **Tarnished Plant Bug Injury to Pears in Washington.**— *J. Econ. Ent.*, xxiv, no. 5, pp. 969–971. Geneva, N.Y., October 1931.

The tarnished plant bug [*Lygus pratensis*, L.] caused particularly severe damage to pear and apple in Washington in 1930, pear orchards with a luxuriant cover crop of lucerne or sweet clover [*Melilotus*] being specially subject to attack. Comparisons of temperature records for the fortnight beginning 31st March, when pear blossoms are swelling and particularly subject to injury, show that more favourable temperatures for insect activity persisted during 1930 than in any other year over the six-year period beginning 1926. The fact that few adults were present on pear buds during the observations renders the value of a contact spray in early spring doubtful, as it appears likely that the bugs spend most of the time on the cover crop or on succulent weeds in or adjacent to the orchard. Spring disking of the cover crop appeared to drive the bugs into the pear trees and rather to increase than diminish the injury caused. Eggs were found in an orchard on lucerne as early as 26th June 1931, deposited on green flower buds before these had opened, and the bug is apparently able to breed readily on this plant. Many of the eggs found commonly on lucerne on 18th July were laid in the axils of the plant and others in the tender stems between the nodes, all being located in the young growth toward the tip.

Lockwood (S.). **Statistical Methods of Value in Field Entomology.**— *J. Econ. Ent.*, xxiv, no. 5, pp. 971–978, 10 refs. Geneva, N.Y., October 1931.

Methods of sampling insect populations and statistical methods of judging the value of average samples are discussed.

de Ong (E. R.). **Present Trend of Oil Sprays.**— *J. Econ. Ent.*, xxiv, no. 5, pp. 978–985, 1 chart, 2 refs. Geneva, N.Y., October 1931.

The following is substantially the author's abstract: The types of oil now commonly used on the Pacific Coast are discussed. The present tendency to use oils with larger amounts of sulphonatable material is made possible by the use of lower viscosities. Such oils are cheaper than the heavier and more highly refined ones and also for some purposes may have a greater insecticidal value. Laboratory data are given on the values for oils of different viscosities, also changes in viscosity through field temperature variations. The preservative action is shown of pine tar oils when used in small percentages with emulsions made with casein or blood albumen, which sometimes lead to bacterial decomposition.

Smith (R. H.). **Studies on the Oil depositing Qualities of Oil Spray Mixtures.**— *J. Econ. Ent.*, xxiv, no. 5, pp. 985-991, 1 pl. Geneva, N.Y., October 1931.

A preliminary report is given of an investigation relating to the standardisation of spray mixtures as regards their performance when applied to trees in leaf, particularly *Citrus*. The factors studied included the quantity of oil deposited and the character of the deposit as related to the percentage of oil in the spray, the physiochemical nature of the spray mixture and each of its constituents, the quantity of spray applied, the manner and duration of application, the manner in which the spray falls upon or strikes the surface, the character of the surface sprayed, the pressure with which the spray is applied and the adjustment of the spray nozzle. The results of experiments carried out to determine the relation between the quantity of oil deposited and insect control and the safety of the tree indicate that sprays of oil and water only, and of oil, water and calcium caseinate were more efficient than those containing blood albumen in the control of the black and citricola scale [*aisset Soleaeia*, Bern., and *Coccus pseudomagnoliarum*, Kuw.]. The largest amount of leaf drop was produced by the spray of oil and water only, defoliation amounting to about 90 per cent. as compared with 75 per cent. produced by sprays containing calcium caseinate spreader (emulsifier). The amount of drop produced with the blood albumen spreader varied inversely with the amount of spreader used, 4 oz. to 100 U.S. gals. producing 60 per cent. and 8 ozs. to 100 U.S. gals. 20 per cent. leaf drop. This spreader consisted of 1 part of blood albumen and 3 parts fuller's earth. The differences in degree of control became less and less as the percentage of oil was increased, with the result that when 2 per cent. of oil was used, the spray containing the blood albumen spreader at 4 oz. to 100 U.S. gals. gave nearly the same control as the spray of oil and water only. This is apparently due to the fact that when 2 per cent. of oil was used sufficient oil was deposited by the spray containing the blood albumen to kill the scales hit, whereas the sprays of oil and water only and of oil, water and calcium caseinate probably deposited a larger amount of oil than was required to kill the scales.

Certain brands of emulsions and tank mixtures [*cf. R.A.E.*, A, xviii, 481] containing certain emulsifying substances have been found to produce particularly heavy initial deposits (the oil that is apparently deposited on the surface the instant the spray strikes it). A study of these emulsions has shown that sprays that produce heavy initial deposits rank high in oil-depositing quality, but the initial deposit does not account for the heavy deposits of all sprays that rank high in oil-depositing quality. It appears that the high oil-depositing qualities of oil-and-water spray and many others that do not produce particularly heavy initial deposits can be explained in part by the wetting quality of the sprays. Sprays that wet and form a film on the surface do not generally rank so high in oil-depositing quality as sprays that wet poorly. Droplets of oil deposited on the smooth lower surface of the citrus leaf do not spread. When the spray contains an effective spreading substance, the formation of a uniform film of oil appears to be due to the following phenomena: the droplets of spray flatten out the instant they strike the surface; the globules of oil are held enmeshed at the surface of the film and do not migrate and form masses at the edges of the droplets; as the water evaporates the spreader lays down a coating on the surface over which the oil spreads in a uniform film.

HERBERT (F. B.). **History of the Oil and Nicotine Combination.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 991–997, 22 refs. Geneva, N.Y., October 1931.

The development of the use of nicotine in combination with mineral oil emulsion is traced from the literature, and a list of insect pests hitherto known to be controlled by it is given. The nicotine-oil combination at present probably controls more pests than any other simple combination, and its range of effectiveness is still far from being exhausted.

EYER (J. R.). **A four-year Study of Codling Moth Baits in New Mexico.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 998–1001, 1 fig., 3 refs. Geneva, N.Y., October 1931.

The following is taken from the author's abstract of this paper, some of the information contained in which has already been noticed [*R.A.E.*, A, xix, 477, 546]. Cane syrup diluted with water at the rate of 1 : 10 proved to be the most attractive of all baits tested in New Mexico against *Cydia* (*Carpocapsa*) *pomonella*, L., during the period 1928–31. The increased attractiveness obtained through delaying fermentation by the addition of 2 per cent. sodium benzoate to this bait is not so marked during the spring months as in the summer when the temperatures are higher. Malt syrup when used without yeast is moderately attractive. The most effective of the commercial esters tested [xix, 547] did not exceed cane syrup in attractiveness, nor did they add materially to the attractiveness of this bait when placed in it or in evaporation cups.

Commercially prepared extracts of the aroma of apple blossoms and of the aroma and flavour of the fruit were not attractive to *C. pomonella*. Esters of malic acid were only slightly attractive and esters of valerianic acid not at all so.

HAGAN (H. R.). **Vacuum Fumigation of Pineapple Planting Material.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 1002–1012, 11 refs. Geneva, N.Y., October 1931.

Pineapple planting material, which consists of slips and suckers from the mature plants and crowns from the fruit, seems invariably to be infested in Hawaii with Arthropods, the most important of which are *Pseudococcus brevipes*, Ckll. (pineapple mealybug) and *Thrips tabaci*, Lind. Additional species present are *Diaspis bromeliae*, Kern., and the mites, *Stigmaeus floridanus*, Banks, and *Tarsonemus ananas*, Tryon.

In preliminary tests in vacuum fumigation, planting material was quite intolerant of carbon bisulphide, considerably more resistant to chloropicrin, and withstood without injury heavy charges of hydrocyanic acid gas, which also gave satisfactory control of mites and mealybugs within the tolerance limits of the plants. The critical dosage for mealybugs is apparently less than 10 or 12 oz. of sodium cyanide to 1,000 cu. ft. of space, the fumigation period being 1–1½ hrs. and the vacuum 28 inches at the beginning of treatment. Tests with hydrocyanic acid gas were carried out only with material that was aired and planted shortly afterwards, no observations having been made as to the possibility of storing fumigated material. Very severe injury resulted from the storage of planting material fumigated with chloropicrin.

Woglum (R. S.). **Industry meeting Quarantine : The Bean Thrips.**— *J. Econ. Ent.*, xxiv, no. 5, pp. 1013–1018, 1 fig. Geneva, N.Y., October 1931.

Occasional damage to cultivated crops has been caused by *Hercothrips* (*Heliothrips*) *fasciatus*, Perg., which breeds freely in prickly wild lettuce (*Lactuca* sp.), a weed widely distributed in California, and subsequently migrates to other plants, congregating commonly on *Citrus* in autumn. The thrips crawl into the navel end of navel oranges for winter protection. During 1930 the Hawaiian Islands placed a restriction on the movement of *Citrus* fruits from California, limiting it to consignments free from *H. fasciatus*, and experiments were accordingly carried out on packed fruit with hydrocyanic acid which demonstrated that eradication was possible by means of a 35 minute exposure in a gas-tight enclosure to a dosage of $\frac{2}{3}$ oz. sodium cyanide to 100 cu. ft. This dosage has been widely used commercially, but with varying degrees of spotting or damage to the fruit. Factors influencing fruit damage were therefore studied, and it was found that whereas an artificial wax covering applied to fruit previously dipped in weak alkali gave increased protection, a wax coating over oranges after dipping in a strong solution of sodium hypochlorite increased spotting to a greater extent than occurred with unwaxed fruit. Fruit fumigated immediately after washing and packing is more severely injured than when an interval of a day elapses, but if the interval is extended to 48 hours the damage appears to increase over that at 24.

Field experience supported by experiments with immature oranges indicates that the rupturing of oil glands in the rind of the fruit influences the degree of pitting following fumigation. Fruit fumigated after injury showed a greatly intensified spotting at pin pricks, some of the pits being $\frac{1}{2}$ in. in diameter. The greater susceptibility to pitting of oranges over lemons is apparently due to a great extent to morphological differences in the two fruits, the oil glands being much more numerous in the orange and the epidermal layer much more easily injured.

Boyce (A. M.). **The Diapause Phenomenon, in Insects, with special Reference to** *Rhagoletis completa* **Cress. (Diptera : Trypetidae).**— *J. Econ. Ent.*, xxiv, no. 5, pp. 1018–1024, 8 refs. Geneva, N.Y., October 1931.

Some of the more important facts relative to the diapause phenomenon in insects are summarised from the literature. *Rhagoletis suavis completa*, Cress. (walnut husk fly), which is injurious to Persian walnut [*Juglans regia*] in California, is an exceptionally good exponent of the diapause phenomenon. The larvae of this fly enter the soil in autumn and pupate. Some of the pupae give rise to adults in the following summer, but an appreciable percentage remains in the soil for a second winter, and there are indications that a few do so for three and even four winters. Since practically all individuals are subjected to similar temperature and humidity conditions in the soil, it seems evident that the forms that require more than one year to emerge are inherently different from the one-year ones. The author has found no hypothesis in the literature that would explain this phenomenon.

The depth to which the larvae penetrate the soil before pupation varies somewhat, depending on the type of soil. Over 85 per cent., however, are in the upper 3 inches of soil, a few may burrow downward to a depth of 7 inches, and during regular orchard cultivation practices the pupae are fairly evenly distributed through the soil to depths of 10 inches and more. Since experiments have demonstrated that pupae lying within 5 inches of the soil surface are killed by high temperatures during the following summer, it must be concluded that cultivation of the soil is beneficial to the fly. Experiments to determine from what depth it was possible for the flies to emerge showed emergences varying from 69 per cent. from a depth of 8 inches to 40 per cent. from a depth of 34 inches. Observations of the length of time the pupae remained in the soil from 1928 to 1930 show that the percentage of the previous year's brood emerging in 1930 was much higher than in the two preceding years. Of several thousand newly-formed pupae placed under indoor conditions in a heated insectary in the middle of October, 0·6 per cent. emerged during the first half of December, and a few adults emerged sporadically until the following August, when the general emergence took place, coinciding with the general behaviour under field conditions.

In an attempt to throw some light on the problem, preliminary experiments have been carried out with various chemicals in an effort to break the dormancy of the pupae. Among the materials used, potassium thiocyanate and thio-urea appear to merit further work. Six months after treatment, which consisted in soaking the pupae for varying lengths of time in the materials and keeping them segregated in sand containers under heated insectary conditions, the batches treated with potassium thiocyanate showed an average emergence of 22 per cent., those treated with thio-urea 21 per cent., and the controls 12 per cent. The emergence in any of the other treated batches did not exceed that of the controls.

KLOTS (A. B.). *Pyralis farinalis* **and the Efficiency of Light-traps.**— *J. Econ. Ent.*, xxiv, no. 5, p. 1024. Geneva, N.Y., October 1931.

After two hours close observation of a light trap from 10 p.m. till midnight, during which period not a single individual of *Pyralis farinalis*, L., entered the trap, a large swarm of these moths was discovered hovering round a disused chicken-coop within 25 ft. of it.

FREEBORN (S. B.). **Citrus Scale Distribution in the Mediterranean Basin.**— *J. Econ. Ent.*, xxiv, no. 5, pp. 1025–1031, 4 refs. Geneva, N.Y., October 1931.

Brief observations are given on the distribution and importance of the more serious Coccid pests of *Citrus* on the shores of the Mediterranean, and on the ecological and administrative factors influencing their distribution. *Chrysomphalus dictyospermi*, Morg., which is the predominant species, is confined to a narrow coastal belt in the west, Syria, Palestine and Egypt being free from infestation. Four generations a year occur in Algeria, but there are only three in Sicily and the French Riviera. Detailed examination in several countries along the northern shores of the Mediterranean showed that many individuals

of *C. aurantii*, Mask. (California red scale) were present in what had been considered pure cultures of *C. dictyospermi*. It is, however, of secondary importance except in Palestine, where the yellow variety (var. *citrinus*, Coq.) also occurs. In Egypt *C. aurantii* confines its activities to ornamental plants. *C. ficus*, Ashm. (*aonidum*, auct.) is the most serious *Citrus* pest in Egypt and Syria, but the Jaffa district in Palestine, lying between the two, has been kept free from infestation, probably by quarantine measures. *C. ficus* occurs only sparsely in Spain, Italy, Greece and Turkey, but is a serious pest of ornamental *Citrus* in Algiers, although it has not spread there to neighbouring commercial plantings.

Parlatoria zizyphus, Lucas, which confines its attacks almost exclusively to *Citrus*, favouring oranges and tangerines, and is most common in Spain, Algeria, Tunis and Morocco, has been generally reported to pass the winter in the egg stage. The author, however, repeatedly observed living females in all stages of growth as late as February in North Africa. It is the most difficult to control of all scales occurring in the Mediterranean. *Aspidiotus hederae*, Vallot, is found throughout the Mediterranean Basin, but seems to confine its attacks on *Citrus* to the fruit of lemons in France and Italy. *Saissetia oleae*, Bern., although generally distributed, is recognised solely as an olive pest except in Tunis, Algeria, Morocco, Spain and southern France. In French North Africa, where it constitutes a serious *Citrus* pest, its distribution is very irregular, some trees even in a single orchard having serious infestations beside others that are immune. In Spain, where it was formerly a serious pest [*R.A.E.*, A, iii, 143], it is now of minor importance, whereas *Pseudococcus citri*, Risso, has become sufficiently numerous to account for practically all damage due to sooty mould.

Ceroplastes spp. (wax scales) although observed in all countries bordering the Mediterranean except Tunis, are only considered serious pests in northern Spain and northern Italy, where *C. sinensis*, Del Guer., appears in overwhelming numbers in cycles of about 3 years. This scale occurs in the Castellon section of Spain annually in serious numbers, and becomes of commercial importance in Algeria although generally on individual trees rather than on entire plantations. *C. floridensis*, Comst., is the species found in Palestine and northern Egypt. *Icerya purchasi*, Mask., although generally distributed, is kept in check by predators. Observations in several plantations tended to confirm the growing belief that it is less readily controlled by predators on trees grown on sweet lemon stock than on those grown on bitter orange stock, although in all cases where attack was serious the trees were also in a poor state of cultivation.

P. citri constituted the most serious insect pest in the Valencia district of Spain in 1930–31, when the measures adopted failed to give more than 70 per cent. control. *Phenacoccus hirsutus*, Green, is apparently the most injurious *Citrus* insect in Egypt, to which country its Mediterranean distribution is limited.

Various questions arising out of these observations concerning the ecology of the various species and part played by quarantines in limiting their spread are briefly discussed, and the impossibility of attempting to predict from the findings in one area how the species under observation will react upon the same food-plant in another, apparently similar, locality is emphasised. The difference in the manner in which modern control methods are adapted to Mediterranean

conditions is shown. Here the fact that the material used in treatment is the most important expense and that of labour almost negligible has reversed the usual ratio between cost of fumigation and oil spraying to a point where the cost of spraying is one-half to one-third that of fumigation, and spray material can be applied far more economically than in California.

Moulton (D.). **Western Thysanoptera of economic Importance.**— *J. Econ. Ent.*, xxiv, no. 5, pp. 1031–1036. Geneva, N.Y., October 1931.

The principal thrips of economic importance occurring west of the Rocky Mountains are : *Heliothrips haemorrhoidalis*, Bch. (greenhouse thrips), *Hercothrips fasciatus*, Perg. (bean thrips), *Scirtothrips citri*, Moulton (orange thrips), *Drepanothrips reuteri*, Uzel (vine thrips), *Frankliniella californica*, Moulton (western flower thrips), *Thrips tabaci*, Lind. (onion thrips) and *Taeniothrips inconsequens*, Uzel (pear thrips). The distribution and food-plants of these thrips are discussed, and their generic and specific characters are briefly enumerated to facilitate their recognition by entomologists working upon this group of insects. *Frankliniella californica* has been found to cause silver spotting on apples in Washington and Oregon and damage lucerne in Colorado, Wyoming and Arizona. It also infests deciduous fruit-tree blossoms, especially almonds, in which it occurs with *Taeniothrips inconsequens*, and *Citrus* blossoms with *Scirtothrips citri*.

Chamberlin (W. J.). **Remarks on the Genus** *Ellopia* **(Order Lepidoptera, Family Geometridae) with special Reference to the Oak Looper,** *E. somniaria* **Hulst and the Hemlock Looper,** *E. fervidaria* **Hubner.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 1036–1041, 2 pls., 26 refs. Geneva, N.Y., October 1931.

A review of the literature dealing with the four species of *Ellopia* known to be of economic importance indicates that *E. fervidaria*, Hb., which is a serious pest of conifers, and *E. somniaria*, Hulst, which defoliates oaks, in the Pacific Northwest, are apparently biological strains of one species. *E. fervidaria* has also been recorded in a strip of territory on the Atlantic coast from Florida to Montreal, on broad-leaved trees and, in Canada, spruce. *E. fiscellaria*, Gn., causes severe damage to conifers in eastern Canada and Wisconsin, and *E. athasaria*, Wlk., attacks hemlock [*Tsuga*] and other trees in Ohio [*cf. R.A.E.*, A, xv, 436].

E. somniaria, although showing a strong preference for oak, was found to feed on numerous other plants, including even hemlock and Douglas fir [*Pseudotsuga taxifolia*], although there was heavy mortality among the larvae when confined to these trees. Records show that it reaches an epidemic stage in the Willamette Valley, Oregon, about every seventh or eighth year, attacks the native garry oak [*Quercus garryana*] for two or three seasons and then practically disappears. Studies carried out during the outbreak of 1929–30 in an attempt to determine the factors responsible for the decline showed that the winter is passed in the egg stage ; the eggs are generally deposited

singly on moss or bark or in crevices and begin to hatch in April. The larvae are abundant in May and begin to mature in July, when the greatest mortality occurs. The Tachinid, *Madremyia saundersi*, Will., was found to be uniformly distributed and parasitised the larvae to the extent of about 3 per cent. The Pentatomid, *Apateticus crocatus*, Uhl., which was predacious on them, only occurred in negligible numbers. By early August the foliage was so badly eaten and dried that it no longer furnished food for the larvae, which began to migrate. They crawled or dropped to the ground, moved away and ascended the first object with which they came in contact, the majority dying because they failed to find food. Mortality in the plots studied was estimated at 75 per cent. Pupation began about 20th August, but a few larvae were still left on 15th September. The pupal stage lasts 21–27 days and experimental rearings indicated a parasitism of about 20 per cent. Males first appeared in the field on 11th September in 1930, but females did not begin to emerge until the end of the month, many of them being destroyed by subsequent heavy fogs and cold rains. Hymenopterous parasites previously recorded as attacking *Ellopia* spp. are enumerated from the literature. Those reared from *E. somniaria* in Oregon were the Chalcid, *Brachymeria ovata*, Say, the Ichneumonids, *Amblyteles cestus*, Cress., *Pimpla* (*Ephialtes*) *sanguinipes*, Cress., and *P.* (*E.*) *obesus*, Cush., and the Pteromalid, *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.).

Pratt (F. S.), Swain (A. F.) & Eldred (D. N.). **A Study of Fumigation Problems : " Protective Stupefaction," its Application and Limitations.**— *J. Econ. Ent.*, xxiv, no. 5, pp. 1041–1063, 4 pls., 8 diag., 5 refs. Geneva, N.Y., October 1931.

The following is taken from the authors' abstract and conclusions : In connection with the fumigation of *Citrus* with hydrocyanic acid for the control of Coccids, it is shown that certain of these insects when first exposed to sublethal concentrations of gas become stupefied and consequently more resistant to the action of HCN than do scale insects not so stupified [*cf. R.A.E.*, A, xviii, 41]. Extensive experiments including 930 separate tests and 340,000 individual scales with *Chrysomphalus aurantii*, Mask., and *Coccus pseudomagnoliarum*, Kuw., and an additional 163 experiments using approximately 45,000 scales with *Saissetia oleae*, Bern., show that an exposure of more than one, but less than three, minutes to sublethal concentrations is necessary to cause this increased resistance. Studies of the concentration and distribution of HCN under fumigation tents show that under summer night fumigation conditions, uniform distribution is accomplished in a short enough time to prevent any protection by stupefaction when the fumigant is applied with an atomiser or vaporiser, but that under winter daylight conditions, the atomising pump does not produce sufficiently rapid distribution to prevent this phenomenon. At any time when the temperature of the ground under the tent is lower than the temperature of the air above, and consequently no convection currents are present, it is necessary to use the vaporiser to obtain quick and uniform distribution of HCN. The results of this investigation, together with that of Gray and Kirkpatrick [*loc. cit.*], show conclusively the value of building up quickly a uniformly high concentration of HCN.

Quayle (H. J.). **Possible future Distribution and Abundance of the Mediterranean Fruit Fly** (*Ceratitis capitata* **Wied.) in the United States.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 1064–1066, 1 ref. Geneva, N.Y., October 1931.

An attempt, based upon data relating to prevailing temperatures and the presence of kind, quantity and sequence of favoured host-fruits in comparison with conditions where *Ceratitis capitata*, Wied., now occurs, is made to indicate the areas in which it would be likely to thrive if it became established in the United States. In southern California, where apricot, peach and oranges provide host-fruits for breeding all the year round, winter temperatures are very little lower than those of Cairo, Egypt, where *C. capitata* is more or less active throughout the year ; whereas the monthly mean winter temperatures in the great peach sections of northern and central California are not sufficiently lower than those of Valencia, Spain, where severe infestation occurs on peaches, to prevent the fly from becoming a serious pest there. It is therefore predicted that on oranges *C. capitata* would be a serious pest in southern California and only to a somewhat less degree in central and northern California, and that peaches would be seriously infested in all these areas.

McGregor (E. A.). **Mortality of the Gray Citrus Scale from Sulfur Dusts.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 1066–1070, 5 refs. Geneva, N.Y., October 1931.

Finely divided sulphur dust, which was first studied against *Lygus elisus*, Van Duzee [*R.A.E.*, A, xvi, 32] and was subsequently found to control the citrus thrips [*Scirtothrips citri*, Moult.], was also observed to effect considerable mortality of the grey citrus scale [*Coccus pseudomagnoliarum*, Kuw.] [*cf.* xviii, 202]. Data accumulated during studies covering a period of 3 years in the San Joaquin Valley, Central California, indicate that mortality of scale following two properly timed dustings is almost as great as that secured with three, as in the second case the first application, forming part of the thrips control programme, is made before the scale hatches and a considerable proportion of it is liable to be removed in the meantime by wind and rain. The dusts used consisted of commercial yellow sulphur of a relatively high degree of purity either alone or in combination with 20 per cent. gas purification sulphur, all ground to approximately 300-mesh fineness. A review of the data shows that on 46 out of 51 plots receiving 2–3 applications of sulphur dust seasonal control was obtained, the actual net mortality ranging from 81·5 to 100 per cent. The normal mean maximum temperatures during the period of application ranged from 66° F. in March to 91·2° F. in June.

Peterson (A.). **Refrigeration of** *Trichogramma minutum* **Riley and other Notes.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 1070–1074, 2 refs. Geneva, N.Y., October 1931.

Refrigeration studies carried out at Columbus, Ohio, during the past two years have shown that whereas adults of *Trichogramma minutum*, Riley, do not live longer than two weeks, and parasitised eggs of *Sitotroga cerealella*, Ol., will not survive much longer than 4–6 weeks, at temperatures approximating 40° F., the parasites can be kept alive in the eggs of *Thyridopteryx ephemeraeformis*, Haw., for

from 40 days to 6 months at such temperatures [*cf.* also *R.A.E.*, A, xix, 203]. The parasitised eggs were kept in lots of 50–75 in shell vials stoppered with cork, a raisin on a pin being inserted in the cork within the vial. The vials were kept in a household refrigerator at 40–45° F., and although the mortality among parasites kept for 3–6 months amounted to 75 per cent., a sufficient number of healthy females emerged to effect mass-production within two or three generations. Mortality among parasitised eggs for periods under 3 months was almost negligible. Temperatures below freezing, averaging 27° F., were much more detrimental than those immediately above 34° F. and fairly high humidity seems to be necessary for the most satisfactory survival. The sex ratio was found to be unchanged by refrigeration.

Observations of the separation of two kinds of females emerging from a shipment of parasitised eggs of *S. cerealella* from New York State showed it to result within two generations in the segregation of two distinct strains (or species), one with decidedly yellow females and the other with decidedly dark and somewhat smaller females [*cf.* xviii, 369]. No evidence of interbreeding took place when males and females of the opposite strains were placed together, and the progeny from such crosses was always male indicating that fertilisation had not occurred. The strain with yellow females was found to live longer and to be more prolific in the eggs of *T. ephemeraeformis* than the strain with dark coloured females.

Sherman III (F.). **Spraying to Control the Codling Moth in south-western Michigan.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 1075–1077. Geneva, N.Y., October 1931.

The following is taken from the author's abstract and summary: Spraying experiments in south-western Michigan indicate that several summer brood sprays of lead arsenate may be necessary to effect satisfactory control of the codling moth [*Cydia pomonella*, L.] on apples, and that the use of a single spray for the summer brood larvae, consisting of 2 lb. lead arsenate to 100 U.S. gals. water, may sometimes cause excessive arsenical residue. Sprays of oil with nicotine sulphate gave good results on an early variety, but were less satisfactory on later varieties. In all cases where oil with nicotine was employed in the summer brood sprays, the arsenical residue on the fruit was greatly reduced. Oil sprays, where applied alone for the summer brood larvae, were ineffective. One proprietary oil when used in combination with nicotine sulphate caused injury to the fruit.

DeCoursey (J. D.). **A Method of Trapping the Confused Flour Beetle, *Tribolium confusum* Duval.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 1079–1081. Geneva, N.Y., October 1931.

Experiments with a number of different liquid and powdered attractants and two types of traps for the control of *Tribolium confusum*, Duv., in shelled maize used for mass breeding of *Sitotroga cerealella*, Ol., showed pieces of corrugated paper 6½ by 5½ ins., into which flour was sifted, to be the most efficient, an average of 46·4 beetles being taken in each of such traps when buried in maize during an exposure of 72 hours. Traps fastened to the walls and ceiling of the moth production room averaged 83 beetles to a trap in several tests. The traps should be removed, burned and replaced with new ones each time.

The number of beetles taken in traps in maize near the outer wall of the room at a temperature of 80° F. was 24, whereas on the opposite side of the room where the temperature was 85° F. the number of beetles to a trap was 52. A corrugated paper trap (2 by 5 ins.) baited with a thimbleful of flour placed in a 2 U.S. qt. fruit jar containing flour infested with *T. confusum* caught 700 beetles at the end of 50 hours, only about 60 beetles being visible on the top of the flour.

Snapp (O. I.) & Thomson (J. R.). **A new Curculio jarring Sheet.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 1082–1083, 1 fig. Geneva, N.Y., October 1931.

A sheet for collecting adults of the plum curculio [*Conotrachelus nenuphar*, Hbst.] by jarring peach trees in spring, which has a number of advantages over any sheet hitherto used, is made by sewing together three 36-inch widths of unbleached cotton sheeting 15 ft. long, each sheet having an area of 9 ft. by 15 ft. No frame is required other than a 10-foot wooden strip, $1\frac{1}{4}$ by $1\frac{1}{4}$ ins., run through a hem at each 9-foot end of the sheet, which serves as a handle. A hem is made along each 15-foot side through which cotton rope is passed and tied round the wooden strips. A chain is placed across the middle of the upper side of the sheet and fastened to the hem ropes. It holds the sheet down and tends to make it bag slightly towards the centre, which causes the weevils to roll to that point where they can be collected or crushed. The sheets can be rolled up and easily carried from orchard to orchard. After two of the sheets are placed under a tree, it is jarred with a pole containing a block at one end, which is covered with a piece of old motor tyre.

Herrick (G. W.) & Horsfall (W. R.). **The Reproductivity of the Bean Weevil (*Mylabris obtectus* Say) as affected by the Vapor of Ethylene Oxide.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 1084–1086. Geneva, N.Y., October 1931.

Preliminary experiments carried out to determine the effect of ethylene oxide fumigation on the reproductiveness of *Bruchus* (*Mylabris*) *obtectus*, Say, are discussed, and the fumigation chamber and technique employed are described. A uniform distribution of heat was maintained, and the air was kept constantly in circulation. The removal of vials containing the Bruchids was effected in 10 seconds or less through a hole 1 inch in diameter, stopped by means of a cork, thus rendering negligible any loss of gas. The adults used for the experiments had emerged from the beans in which they were bred within an interval of $1\frac{1}{2}$ days. They were fumigated with 55 cc. ethylene oxide to 100 cu. ft. at a temperature of 75–76° F., the relative humidity being 50 per cent. Oviposition was shown to be definitely stimulated by short exposures, and half-hour exposures appeared to hasten the hatching of the eggs, but the number of eggs laid and the number hatching decreased with the longer exposures, and the number of days before viable eggs were laid by the Bruchids increased with the length of exposure. The mean periods of oviposition and hatching were longer with the longer exposures, and the mean longevity of the adults was as long or longer than those of the check, indicating that there were no lethal effects within the range of exposures used. Owing to insufficiency of data and difficulty in controlling variable factors, the results hitherto obtained cannot be looked upon as final.

Hutson (R.). *Phyllocoptes cornutus* **Banks in Michigan.**—*J. Econ. Ent.*, xxiv, no. 5, p. 1086. Geneva, N.Y., October 1931.

Microscopic examination of peach leaves, presenting a silvery appearance and collected early in October 1930 from two localities in Michigan, revealed the presence of *Phyllocoptes cornutus*, Banks (peach silver-leaf mite).

Orr (L. W.) & Hall (R. C.). **An Experiment in direct biotic Control of a Scale Insect on Pine.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 1087–1089. Geneva, N.Y., October 1931.

In the course of experiments carried out in Minnesota in 1929 on the control of *Toumeyella numismatica*, Pett. & McD., in a plantation of Jack and Scots pines [*Pinus banksiana* and *P. sylvestris*], it was found that the infestation was practically wiped out by the end of the season by Coccinellid larvae, mainly those of *Hyperaspis signata*, Ol. This beetle was therefore introduced in May 1930 into Michigan to control a small infestation of *T. pini*, King, on Scots pine, which was discovered there in the autumn of 1929. Several examinations made during the following summer showed that the Coccinellids were abundant on the infested trees, and in October 1930 only 8 out of 690 trees had any scale on them as compared with 78 in May. Counts of the number of scale present on these trees showed only from 1 per tree to 7·2 per linear inch of twig as compared with an average of 33·6 per inch on twigs taken from an infested plantation six miles away. A few adults of *Coccinella perplexa*, Muls., were collected in the experimental area, and this beetle may have been partly concerned in the control of the scales, but as it was probably present in the neighbouring plantation as well, the introduced species was no doubt mainly responsible for bringing about the reduction. It is suggested that breeding these beetles in large numbers for liberation in forests where incipient or local outbreaks are found would ensure more rapid control than that occurring in nature.

Bodenheimer (F. S.) & Schmidt (C. T.). **The Robinson Method for Determination of bound and free Water in the Insect Body.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 1090–1093, 6 refs. Geneva, N.Y., October 1931.

In view of the difficulty of obtaining the original paper describing them [*R.A.E.*, A, xvi, 504], an attempt has been made to repeat the fundamental experiments of W. Robinson in regard to the water metabolism of insects, and the procedure is re-described in a manner likely to make the method more readily available for biological workers. The theoretical background of the experiment is this: At −20° C. [−4° F.], all the free body water in an insect may be regarded as frozen, whereas the bound water is unchanged. If by calorimetric measurement the quantity of frozen free water is determined, the difference between the total water content and the quantity of frozen free water represents the bound water content of the body.

Compton (C. C.). **Red Spider Control in Greenhouses.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 1094–1097. Geneva, N.Y., October 1931.

The following is taken from the author's abstract: A large number of tests have shown that the addition of ½ per cent. penetrol greatly increases the effectiveness of derrisol in the control of red spider (*Tetranychus telarius*, L.) on greenhouse plants. Derrisol 1 : 400 with the addition of penetrol 1 : 200 has been found to be effective against the eggs as well as the mites. Commercial control has been obtained in a number of cases by making two applications of this mixture with an interval of 8 days, without injury to plants beyond the removal of the bloom on the stems and leaves of carnations.

Knowlton (G. F.) & Janes (M. J.). **The Grasshopper Outbreak in Utah–1931.**—*J. Econ. Ent.*, xxiv, no. 5, p. 1097. Geneva, N.Y., October 1931.

A brief note is given on the serious injury caused to almost all agricultural crops in many districts of Utah in 1931 by grasshoppers, the most destructive species being *Melanoplus mexicanus*, Sauss. (*atlanis*, Riley), *M. bivittatus*, Say, *M. packardi*, Scud., *M. femur-rubrum*, DeG., *Aulocara elliotti*, Thomas, and *Dissosteira carolina*, L.

Richardson (H. H.). **The Pyrethrin I Content of Pyrethrum Powders as an Index of insecticidal Power.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 1098–1106, 11 refs. Geneva, N.Y., October 1931.

The following is the author's abstract: The pyrethrin I content of several fresh pyrethrum powders was found to give an accurate evaluation of the insecticidal power of kerosene extracts of these flowers. Pyrethrin I was analysed by Tattersfield's short acid method; insecticidal power was estimated by the speed of paralytic action against house-flies (*Musca domestica*, L.). A correlation coefficient of 0·987 was found between these two factors. The above conclusion was found to hold true for deteriorated pyrethrum as well as for fresh powder.

Smith (C. R.). **Neonicotine recently found as an Alkaloid in *Anabasis aphylla* L.**—*J. Econ. Ent.*, xxiv, no. 5, p. 1108. Geneva, N.Y., October 1931.

The isolation from *Anabasis aphylla* of an alkaloid named anabasine and identified as β-pyridyl-α-piperidine, having the structure already assigned to neonicotine [*R.A.E.*, A, xix, 100], has been recorded in a recent work by Orechoff and Menschikoff (*Ber. deuts. Chem. Ges.*, Feb. 1931, p. 266). A sample of the plant alkaloids has now been obtained, and the identity of the two compounds has been proved by direct comparison. Methyl nicotine was also found to be present. *A. aphylla* is described as a perennial weed growing in northern Africa, Armenia, Russia and neighbouring countries. There are more than 50 species of the genus, but no others have been examined. It seems likely that the anabasine alkaloids may soon be commercially obtainable.

DeLong (D. M.). **A successful Method for sampling Populations of quick moving Insects.**— *J. Econ. Ent.*, xxiv, no. 5, pp. 1108–1109. Geneva, N.Y., October 1931.

This method, which facilitates the capture and examination of all the insects on a given plant or portion of foliage, consists of applying a dust, such as a calcium cyanide, that releases a quick-acting gas, which causes the insects to drop on a canvas sheet spread under the entire treated portion of the plant. The material on the canvas is then shaken upon a 40–50 mesh screen to separate the dust from the specimens. More than 2,000 leafhoppers have been obtained in this way from a single large limb of an apple-tree. The greatest value hitherto derived from such sampling has been the determination of the predominant species, or the relative percentages of different species in a sample. The method is best adapted for arboraceous plants, but it can be used for some types of herbaceous plants, although it has not yet been successfully adapted for field or forage crop sampling.

Smith (H. S.) & Compere (H.). **Notes on** *Ophelosia crawfordi*.— *J. Econ. Ent.*, xxiv, no. 5, pp. 1109–1110. Geneva, N.Y., October 1931.

The Pteromalid, *Ophelosia crawfordi*, Riley, was described in 1890 from specimens reared from eggs of *Icerya purchasi*, Mask., collected in Australia. Successive attempts during the following ten years to introduce it into California apparently failed to result in its establishment. In 1931, S. Flanders obtained this parasite in New South Wales from an egg sac of *Pulvinaria* sp. and from egg masses of *Pseudococcus citri*, Risso, the half-grown larvae being observed feeding in the centre of the egg masses, and also, as a hyperparasite, from the mummified bodies of an undetermined species of *Pseudococcus* on quinces. Moreover he reared two females of a parasite that he could not distinguish from *O. crawfordi* from a mummified Coccinellid larva taken on a tree.

Adults of *O. crawfordi*, bred in California from material sent by Flanders, readily reproduced in jars when provided with mealybugs that had begun to oviposit. The parasite eggs are laid among those of the mealybug, upon which the larvae subsequently feed. They pupate in the remains of the old egg masses. The life-history of *O. crawfordi* on mealybugs resembles that of *Tomocera californica*, How., which parasitises the eggs of *Saissetia oleae*, Bern., and is known to be capable of developing as a hyperparasite under certain conditions, though it has only once been observed to do so, a single individual having been recorded by P. H. Timberlake as developing on *Microterys flavus*, How., within *Coccus hesperidum*, L.

It is almost certain that the parasites reared by Flanders from *Pseudococcus* sp. on quinces, developed at the expense of a primary parasite, possibly *Anarhopus sydneyensis*, Timb. [*R.A.E.*, A, xvii, 392], which also issued from the same lots of material. The record from a Coccinellid larva may be considered unique. It is supposed that the larva, a species of *Chilocorus* or *Orcus*, was first attacked by an Encyrtid, *Homalotylus* sp., and that before the larvae of the latter had pupated they were destroyed by *O. crawfordi*, two females of which finally issued from it.

As the mealybug situation in California is at present very satisfactory and it is impossible to determine whether *O. crawfordi* would prove to be beneficial or injurious, the colonies of this parasite have been destroyed without making any liberations.

POTTS (S. F.) & BARNES (D. F.). **Adhesives and Carriers for insecticidal Dusts.**— *J. Econ. Ent.*, xxiv, no. 5, pp. 1110–1111. Geneva, N.Y., October 1931.

A brief preliminary report is made concerning the most promising adhesives and carriers discovered in the course of an investigation, carried out over a period of 5 years in Massachusetts in connection with the control of the gipsy moth [*Porthetria dispar*, L.], in regard to the adherence of insecticidal dusts to growing and mature foliage. Leaf collections for analysis to determine the degree of adherence were made at the time of application, just before rain and dew formation to learn the percentage of loss from wind, and after various quantities of rain had fallen. When applied without an adhesive, as much as 25 per cent. of lead arsenate remained on the foliage after 1 inch of rain, whereas the figure for calcium arsenate was less than this after only 0·2 inch of rain. Magnesium arsenate adhered better than calcium arsenate, but not nearly so well as lead arsenate. The best grades of hydrated lime did not adhere so well as lead arsenate, but adhered a little better than copper sulphate and lime mixtures and much better than calcium arsenate, magnesium arsenate, sulphur and the fluosilicates. Poor grades of hydrated lime adhered about as poorly as calcium arsenate. When lime was mixed with insecticides having better adherent qualities than lime, the adherence of the insecticide was greatly reduced. With dehydrated copper sulphate dust, the addition of lime is necessary, whereas with most other materials, where only a carrier or diluent is needed, some other material such as talc or a finely powdered clay (bentonite) can be substituted. Lime is caustic to the operator and does not adhere nearly so well as talc or bentonite, which can be added as adhesives in proportions of 1 : 4 to insecticides not requiring diluents or carriers.

Lamp black, powdered bone black and activated carbon all adhered well, but their colour and adherence to clothing preclude their use. In the course of experiments in which 200 plots were dusted with various mixtures, the following promising adhesives were found: finely powdered commercial (not proprietary) ferric oxide, powdered casein glue, linseed oil or fish oil, and finely powdered milk. The best results were obtained where the powdered adhesive made up 20 per cent. of the weight of the dust mixture. Dust mixtures containing oils were effective only when moistened on the foliage by dew or fog during or immediately following application; as much oil should be added as possible without interfering with application [*cf. R.A.E.*, A, xviii, 211–213].

The average loss of insecticides by wind from plots treated in the morning after dew had completely dried was as much as 40 per cent., but this loss can be almost entirely avoided by applying the material in the late afternoon. All materials tested adhered best when moistened on the leaf surface during or soon after application. The loss of toxicity is relatively greater during the first rain than from later rains. The first ½ inch of rain removes more arsenical than the following 2 inches. Loss in concentration on expanding foliage is

rapid even though no weathering occurs, and in general is inversely proportional to the increase in leaf area. The reduction is increased by weathering. There is a wide range in degree of adherence to the foliage of different species of trees.

ARMITAGE (H. M.). *Gelechia desiliens* **attacks Sycamores.**—*J. Econ. Ent.*, xxiv, no. 5, p. 1111. Geneva, N.Y., October 1931.

Severe injury was caused in June 1931 in the neighbourhood of Los Angeles to a number of sycamores [*Platanus*] by *Gelechia desiliens*, Meyr., the larvae of which fed on the upper surface of the older leaves and completely destroyed portions of the younger ones. No food-plant of this moth has hitherto been recorded.

ESSIG (E. O.). **The Negro Scale in California.**—*Pan-Pacific Ent.*, viii, no. 1, p. 36. San Francisco, Cal., July 1931.

It has been thought that *Saissetia nigra*, Nietn., is unable to survive outdoor conditions in California, though it occasionally occurs in greenhouses there and has often been taken in quarantine on plants from greenhouses or tropical and subtropical regions. It was, however, observed in 1920 on *Euonymus* and again in 1931 in the same place on *Pittosporum* and elsewhere on *Aralia* in a nursery ; it thus appears able to maintain itself and even increase under certain conditions. Its presence in 1931 may have been due to the mildness of the last few winters.

OMAN (P. W.). **New Jassinae, with Notes on other Species.**—*J. Wash. Acad. Sci.*, xxi, no. 17, pp. 430–436, 6 figs. Washington D.C., 19th October 1931.

From a comparison of specimens, including two identified by Matsumura, the author finds that *Platymetopius cinctus*, Mats., described from maple in Japan, is synonymous with *P. hyalinus*, Osb., thus confirming the belief that this leafhopper was introduced into the United States on maple [*R.A.E.*, A, viii, 147]. Since its importation it has spread rapidly and has now been found as far west as Ohio. It has also been recorded from Oregon, indicating its introduction on the west coast as well as the east.

MCDANIEL (E. I.). **White Pine Weevil is increasing in Michigan.**—*Quart. Bull. Michigan Agric. Expt. Sta.*, xiv, no. 1, pp. 36–38, 2 figs., 1 ref. East Lansing, Mich., August 1931.

Brief notes are given on the bionomics and control of *Pissodes strobi*, Peck [*cf. R.A.E.*, A, xviii, 416, etc.] in Michigan where, in addition to white pine [*Pinus strobus*], it has been found on Jack pine [*P. banksiana*] and Norway spruce [*Picea excelsa*]. Hemlock [*Tsuga*], arborvitae [*Thuja*] and balsam fir [*Abies balsamea*] are apparently immune. The terminal growths of the tallest trees are selected for oviposition, and the range of flight of the weevils may be raised above white pines by growing them under a nurse crop of hardwood trees. The planting of a rapid-growing variety such as Scots pine [*Pinus sylvestris*] is recommended in mixed stands of conifers, as it is ready for cutting by the time the white pine has matured beyond the stage during

which it is susceptible to attack. The weevils are only active between temperatures of 70 and 85° F. Uninfested trees may be attacked during May and June if the prevailing wind is blowing from an infested area.

LACROIX (D. S.). **Tobacco Insect Studies in 1930.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 326, pp. 419–431, 9 figs. New Haven, Conn., February 1931. [Recd. November 1931.]

In 1930, serious injury was caused to newly transplanted tobacco by *Phorbia* (*Hylemyia*) *cilicrura*, Rond. (seed corn maggot) and *Pheletes* (*Limonius*) *agonus*, Say, in Connecticut, about 50 per cent. of the tobacco acreage being infested by the wireworms alone. The presence of these two pests necessitated in many cases a second, and sometimes even a third, transplanting. Although tobacco set out after 10th June suffered no injury, earlier planting is necessary to ensure curing the tobacco during the heat of late summer. Grasshoppers were particularly abundant in fields planted near hay land or in those that had been under hay the year before. *Melanoplus femur-rubrum*, DeG., was responsible for considerable injury, and *Dissosteira carolina*, L., was frequently associated with it, though less abundant. In experiments the hoppers of these and another species, probably *M. mexicanus*, Sauss. (*atlanis*, Riley), were controlled by a bait of 25 lb. bran, 1 lb. Paris green, 6 oranges and 2 U.S. quarts molasses, moistened with water. The bait causes scorching if allowed to come in contact with the foliage. *Protoparce quinquemaculata*, Haw., and *P. sexta*, Joh., though generally distributed over the tobacco-growing area, were not plentiful. *Papaipema nebris*, Gn. (*nitela*, Gn.) was found in one locality tunnelling stalks near the edges of the field, but injury to tobacco by this borer was not widespread.

Epitrix cucumeris, Harr., occurred on Havana seed and shade grown tobacco throughout the season, but caused most injury in late July, 25–30 per cent. of the acreage suffering material loss. Observations of its activities in various parts of a tobacco plantation showed that it is more abundant on shade-grown tobacco in the later part of the season, its greatest abundance being reached about 10–14 days earlier than on sun-grown tobacco, and coinciding approximately with the picking of the first leaves. A secondary increase in numbers early in July, followed by a decline, suggests that there are at least two broods. By 20th August practically all the beetles had disappeared. In the latter half of July, it feeds on both surfaces of the leaf, whereas its earlier activities are confined to the lower surface. The lower leaves are first attacked, and the beetles migrate upwards from leaf to leaf. Where tobacco is planted in proximity to potato the beetles show a preference for the latter, and the tobacco remains uninfested until the potato plants begin to dry up. It is therefore suggested that the juice of potato plants might be used as an attractant in poison baits.

In the course of experiments with several insecticides against this flea-beetle, a dust of Paris green and calcium arsenate (1 : 5), applied at the rate of about 10 lb. to the acre on young plants, was found to check the infestation to some extent, but as the plants increased in size an increased dosage of 15–18 lb. was necessary to secure good coverage. Where repeated applications had to be made in consequence of frequent rains, extensive scorching resulted, injury being particularly

serious at the base of the stalk where the dust accumulated. In some cases the stalk actually broke off at this point. When the mixture was diluted with lime (1 : 5), injury was slight. Tobacco dusted with full strength mixture was uniformly smaller. Good results were obtained with cryolite and barium fluosilicate, neither of which caused foliage injury. Although the action of barium fluosilicate was slow, it reduced the number of flea-beetles to a minimum. The dusts were used at full strength at the rate of 30 lb. to the acre. Beetles became abundant, however, about a week after dusting was discontinued on 16th July to avoid residue on the foliage. Satisfactory control can therefore only be secured either by complete suppression of the first brood or by the discovery of an insecticide that may be used up to the time of harvest without leaving a troublesome residue.

FILINGER (G. A.). **The Garden Symphylid,** *Scutigerella immaculata* **Newport.**—*Bull. Ohio Agric. Expt. Sta.*, no. 486, 33 pp., 19 figs., 4 pp. refs. Wooster, Ohio, September 1931.

This paper contains a more detailed account of the bionomics and control of *Scutigerella immaculata*, Newp. (garden Symphylid) than one already noticed [*R.A.E.*, A, xvi, 518]. The synonymy and history are discussed, and the stages, anatomy and methods of rearing are described. Food-plants other than those mentioned previously [*loc. cit.*] are radishes, parsley, spinach and various flowers grown under glass and such crops as celery, carrots, egg-plant [*Solanum melongena*], beets and asparagus grown in the vicinity of greenhouses. Most of the eggs are laid during the spring and early summer, but in greenhouses oviposition apparently continues throughout the year. At approximately 70° F. the larvae hatch in 7–20 days or an average of 10·8. Sexual maturity is reached in 40–60 days at room temperature. When the temperature at the surface of the soil reaches 70–75° F., the Symphylids descend to 24–36 inches below the surface.

During the last few years experiments have been carried out to determine some means of control in the greenhouses of south-western Ohio. As the Symphylids are easily crushed by disturbance of the soil, the efficiency of the various treatments was ascertained from the condition and yield of the crop that followed rather than by counts of the number of individuals alive and dead. Of the methods applicable before the planting of the crop, other than those mentioned previously [*loc. cit.*], paradichlorobenzene (1 lb. to 100 sq. ft.), carbon bisulphide (1 oz. to 1 sq. ft.) or calcium cyanide (1 lb. to 75 sq. ft.) were effective as soil fumigants when applied during the "making up" process. Larger amounts of paradichlorobenzene stunted the crop following its application. Neither the pan and harrow systems of steam sterilisation nor surface applications of carbon bisulphide gave satisfactory control. Of the treatments applicable after the planting of the crop, carbon bisulphide, at the rate of 4 lb. to 150 ft. of plant row, drilled about 4 inches from the base of the plants and about 2½ inches below the surface of the ground was satisfactory. When volatilised with steam and forced into tiles in the soil, the penetration was uneven, excellent control being obtained in patches [*cf. R.A.E.*, A, xvii, 183, 552]. This material may also be applied to beds of growing plants by pouring 1 oz. into holes 15 inches deep spaced a foot apart along both sides of the row about 4–5 inches from the bases of the plants.

Heavy applications of manure or other organic matter render the soil very porous, a condition that is ideal for the Symphylid, and should therefore be avoided on infested beds.

Little work has been done in Ohio with regard to the control of *S. immaculata* in the field. Some control was reported from carbon bisulphide drilled into the soil before planting in the late spring. In California flooding is considered the only practical method of control in the field, but irrigation facilities are lacking in Ohio.

PAINTER (R. H.), SALMON (S. C.) & PARKER (J. H.). **Resistance of Varieties of Winter Wheat to Hessian Fly,** *Phytophaga destructor* **(Say).**—*Tech. Bull. Kansas Agric. Expt. Sta.*, no. 27, 58 pp., 7 figs., 24 refs. Manhattan, Kans., August 1931.

The following is taken from the authors' summary of their report on eight years' study of the problem of resistance of wheat to *Mayetiola* (*Phytophaga*) *destructor*, Say (Hessian fly) in Kansas.

The methods of measuring the differential infestations of varieties of wheat are analysed and the resistance observed in certain varieties is discussed, data being given on about 400 varieties, selections and hybrids. Evidence is presented which indicates that varieties may be pure or homozygous so far as agronomic characters are concerned and impure or heterozygous for fly resistance factors. Factors conducing to resistance are shown to be inherited and may be combined with other desirable characters. Characteristics that affect the resistant qualities of wheat varieties are : a decided difference in the number of flies that develop on the several varieties ; a kind of tolerance that permits the fly to develop without material damage to the plant ; the ability of some varieties to develop the fly better and faster than others ; the ability of wheat to produce tillers after infestation ; and the stiffness of straw in relation to damage by the fly. Detailed information is given concerning the evidence for the presence of distinct biological strains of the fly, one in the hard-wheat belt of central and western Kansas and one in the soft-wheat belt of eastern Kansas [*cf. R.A.E.*, A, xviii, 477].

BACK (E. A.) & COTTON (R. T.). **Control of Insect Pests in stored Grain.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1483 revd., 33 pp., 37 figs., 2 refs. Washington, D.C., June 1931.

This revision of previous bulletins [*R.A.E.*, A, xiv, 470 ; xviii, 347] includes directions for the preparation and application of a mixture of ethylene oxide and carbon dioxide for the fumigation of stored grain in bulk [xviii, 647].

QUAINTANCE (A. L.) & SIEGLER (E. H.). **Insecticides, Equipment, and Methods for controlling Orchard Insect Pests.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1666, 92 pp., 78 figs., 8 refs. Washington, D.C., September 1931.

In this bulletin, which supersedes one already noticed [*R.A.E.*, A, vi, 465], the methods for applying stomach poisons (which with the exception of hellebore are all arsenicals), fumigants, and contact sprays and dusts in orchards are discussed, the necessary equipment for their use over large and small areas being described. Various

treatments for the protection of the trees against insects are outlined, and notes are given on the common pests of apple, pear, quince, peach, cherry, plum, grape, currant and gooseberry in the United States, with schedules for spraying apple, peach, cherry, plum and grape.

Volck (W. H.) & Hunt (R. W.). **Citrus Pest Control in Southern California.**—Demy 8vo, 24 pp., 6 charts, 1 graph. Berkeley, Cal., California Spray-Chem. Co., 15th June 1930. [Recd. November 1931.]

Detailed instructions are given for the application of various proprietary insecticides against the following pests attacking *Citrus* in southern California: *Chrysomphalus aurantii*, Mask., *C. aurantii citrinus*, Coq., *Lepidosaphes beckii*, Newm., *Saissetia oleae*, Bern., *Coccus pseudomagnoliarum*, Kuw., *Paratetranychus citri*, McG., *Scirtothrips citri*, Moult., the citrophilus mealybug [*Pseudococcus gahani*, Green] and Aphids.

Fisher (D. F.) & Reeves (E. L.). **Arsenical and other Fruit Injuries of Apples resulting from Washing Operations.**—*Tech. Bull. U.S. Dept. Agric.*, no. 245, 12 pp., 3 pls., 11 refs. Washington, D.C., June 1931.

The following is the authors' summary: Calyx scald is primarily caused by the presence of soluble arsenic on the apples. This was proved by producing the injury by application of soluble arsenic to the apples and by isolating soluble arsenic from the injured tissues. This injury occurs on unpicked apples in the orchard and on uncleaned picked apples that have become wet, but most commonly on apples that have been subjected to washing processes. Its occurrence follows the use of either hydrochloric acid or alkaline solvents as washing materials. Chemical injuries to apples from hydrochloric acid and alkaline solvents are described and differentiated from the injury caused by soluble arsenic. These injuries have been found only occasionally and rarely cause commercial losses. The prevention of injury from soluble arsenic and from various chemical solvents commonly used in washing apples depends primarily on the adequate rinsing of the fruit with clean water. Where sufficient water is not available the addition of lime to the rinse water is beneficial. Core rots are increased by methods of washing that permit solutions contaminated with fungus spores to penetrate through open calyx tubes. Varieties commonly characterised by open calyx tubes, therefore, should be washed by methods that do not cause penetration. Injury may result when apples are held in solutions heated to 100° F. or higher for periods of three minutes or longer. Apples are more susceptible to this injury at the time of harvest than after being kept for several weeks. Loss from storage rots may be somewhat greater on washed apples, owing to the extra handling to which they are subjected. Careful handling to avoid bruising or puncturing the skin, and the use of copious quantities of fresh rinsing water under pressure are important factors in reducing losses from storage rots. Where the washing is properly done, the market value and the keeping quality of apples are not impaired and may even be improved.

Ocfemia (G. O.). **The Bunchy-top of Abacá and its Control.**—*Philipp. Agric.*, xx, no. 5, pp. 328–340, 6 figs., 8 refs. Laguna, P.I., October 1931.

Sprays of tobacco decoction, nicotine sulphate, derris or soap solution, formulae for which are given, are recommended for the control of the Aphid, *Pentalonia nigronervosa*, Coq., which is the vector of bunchy-top of Manila hemp [*Musa textilis*] in the Philippine Islands [*cf. R.A.E.*, A, xviii, 243, etc.]. Infected plants of this and other species of *Musa* should be dug up entire, chopped in pieces and sprayed with one of the solutions, together with the soil around them. The corms should then be burnt sufficiently to prevent them from sprouting and furnishing infectious material for the Aphids. The removal of plants of the genus *Musa* or of soil from infected areas to healthy ones should be prohibited.

Clark (A. F.). **The Parasite Control of *Gonipterus scutellatus* Gyll.**—*N.Z. J. Sci. Tech.*, xiii, no. 1, pp. 22–28, 10 figs., 9 refs. Wellington, N.Z., August 1931.

The Australian leaf-feeding weevil, *Gonipterus scutellatus*, Gyll., causes serious defoliation to practically all species of *Eucalyptus* throughout New Zealand. In D. Miller's account of its bionomics [*R.A.E.*, A, xvi, 250], two generations annually are recorded. In the Provinces of Nelson and Canterbury, however, and probably elsewhere in the South Island, there is only one generation. The newly emerged females are numerous in February and feed until forced into hibernation by climatic conditions. Oviposition begins in late October, increases during November and early December and ceases in mid-January, and it is still undetermined whether the introduced egg-parasite, *Anaphoidea nitens*, Gir. [xix, 447] can survive the lengthy period when eggs are absent. It may be significant that recoveries in the field have been confined to the warmer localities of the North Island.

During the season 1929–30, attempts to rear this Mymarid from material collected mainly in the South Island and Wellington districts gave negative results. Further supplies were obtained from Australia, and three generations having been reared in the laboratory, adults were distributed locally in the Nelson district. The work of rearing and distribution was discontinued before the end of the season, owing to the recovery of the parasite in the field at Auckland, where it was originally distributed, and about 100 miles south of Auckland, where it had spread naturally. Attempts to recover it in the field at Nelson again failed in the 1930–31 season, but fresh liberations of adults were effected there and in various districts in the North Island with material from Auckland. General field observations in Auckland indicate a satisfactory degree of control, there being a notable absence of weevils and a marked improvement in the condition of the trees.

All stages and the method of oviposition of *A. nitens* are described. The immature stages are passed in the egg of the host, the incubation period lasting 1–2 days, the teleaform stages 2–3, the remainder of the larval stage 3–4, and the pupal 10–12. In the laboratory the adults lived for a maximum of 3 days. Two parasites may develop in one egg of *G. scutellatus*, though this is probably not common. The length of the immature stages varied from 17 to 22 days for examples from Auckland that were the progeny of individuals originally intro-

duced in 1927–28, and from 22 to 30 days for three generations bred from material obtained from Australia in 1929–30. It appears that the establishment and breeding of the parasite in the field for 3 seasons in Auckland has led to a decrease in the length of the immature stages.

Nymphs of the last instar and adults of the Pentatomid, *Cermatulus nasalis*, Westw., are predacious on the larvae of the weevil, though it is not as yet of much importance in control. According to J. G. Myers, it also attacks *Caliroa* (*Eriocampoides*) *limacina*, Retz. (pear and cherry sawfly), the Cicadid, *Melampsalta cruentata*, F., and the larvae of several Noctuids. It is not wholly predacious and has been observed with its rostrum in the leaves of *Eucalyptus*. It also occurs in Australia. In New Zealand it is found most frequently in the native forests, though it appears to be increasing in cultivated areas.

Miller (D.). **Bronze Beetle. Report on Control Experiments using Chemical Spray.**—*N.Z. J. Sci. Tech.*, xiii, no. 1, pp. 34–36. Wellington, N.Z., August 1931.

Though good results have been obtained in the control of the bronze beetle [*Eucolaspis brunnea*, F.], which is a serious pest of apples in New Zealand [*cf. R.A.E.*, A, xix, 257], with calcium cyanide dust [xiv, 237], experiments with sprays were undertaken in November and December 1929, since spraying is the prevailing orchard practice. The weather was unfavourable, but the results indicate the possibility of successful control. Owing to the various disadvantages of using Paris green, which in one experiment gave 98·9 per cent. control, calcium arsenate was the most satisfactory of the insecticides tested, a control of 96·3 per cent. being obtained with 50 oz. to 5 lb. slaked lime and 100 gals. water and one of 94·35 per cent. with a dust of 19 parts to 9 of sulphur and 52 of lime. Further experiments to determine the most effective concentrations will be undertaken.

de Lepiney (J.) & Mimeur (J. M.). **Les Coccides du Maroc. Note préliminaire.**—*Rev. Path. vég. Ent. agric.*, xviii, no. 7, pp. 243–255. Paris, July 1931.

A preliminary list is given of 79 Coccids found in Morocco, among which are 13 hitherto unknown in the country. About 70 of the food-plants constitute new records as regards Morocco for the species found feeding on them.

Amsel (H. G.) & Hering (M.). **Beitrag zur Kenntnis der Minenfauna Palästinas.** [A Contribution to the Knowledge of the Leaf-miners, of Palestine.]—*Deuts. ent. Z.*, 1931, no. 2–3, pp. 113–152, 2 pls., 5 figs., 4 refs. Berlin, November 1931.

Notes are given on 46 Lepidoptera, 22 Diptera, 9 Coleoptera and 2 Hymenoptera, recorded under their food-plants as leaf-miners, observed in Palestine in 1930. Names are given to some new species, descriptions of which will be published later.

La maladie et les ennemis des ormes.—*Rev. Zool. agric.*, xxx, no. 3, pp. 41–47. Bordeaux, 1931.

Dutch elm disease, which was first observed in northern France about 15 years ago, is now widely distributed and causes great losses. It has

recently been shown to be due to the fungus, *Graphium ulmi*, which is transmitted by Scolytids [*R.A.E.*, A, xx, 4, etc.]. Of these, *Scolytus* (*Eccoptogaster*) *scolytus*, F., has two generations annually, the adults appearing in May and again in the latter half of August. The larval galleries in the cambium interfere with the functions of the tree and may cause the crown and then the trunk to dry up. *S.* (*E.*) *multistriatus*, Marsh., has similar habits, but attacks the smaller branches. Dying trees should be cut down, and the bark immediately removed from the trunk and large branches and burnt, together with the whole of the smaller branches.

Elms are sometimes defoliated by *Galerucella* (*Galeruca*) *luteola*, Müll., and as a result are so weakened that they are particularly subject to the attacks of the Scolytids and, consequently, the disease. The adults emerge from hibernation just as the leaves appear on the trees, and attack these, leaving oval-shaped holes in them. Eggs are deposited on the lower surface of the leaves, and after a week or two the larvae hatch and begin to skeletonise them. After about a fortnight, they pupate either in cracks in the bark of the trunk or in the soil. The pupal stage lasts only 5 or 6 days, and the number of generations varies with meteorological conditions. Collection of the adults and larvae is recommended.

Mayné (R.). **Du rapport entre l'extension des forêts de résineux et le développement des Scolytes.**—*C.R. Cong. Nat. Sci. Bruxelles 1930*, reprint 4 pp. Liège, 1931.

The connection between the extension of areas devoted to conifers in Belgium and the appearance there of Scolytids new to the country are briefly discussed. Lists are given of the Scolytids known to attack pines, which have been longest established in the country; those infesting spruces, the introduction of which is more recent; and certain species common on either or both of these groups in western Germany and likely to spread to Belgium. Scolytids specific to *Abies pectinata*, which is only cultivated to a very limited extent, are entirely absent, the only two species attacking *Abies* in Belgium being common to all three groups. Only 3 out of 17 species attacking *Pinus* are comparatively new to the Belgian fauna, and these do not appear to be increasing to any extent, whereas 5 out of the 12 species attacking spruce are more or less recent introductions and are increasing rapidly.

Duffield (C. A. W.). **Entomological Department.**—*Ann. Rep. S.-E. Agric. Coll. Wye 1929–30*, pp. 68–78. Wye, Kent [1930]. [Recd. October 1931.]

Notes are given on the incidence of insect pests in south-eastern England during the period 6th March to 30th September 1930, which, with the exception of severe infestations of earwigs [*Forficula auricularia*, L.] and winter moths, particularly *Cheimatobia brumata*, L., on fruit trees, was more or less normal. The Capsid, *Campylomma nicolasi*, Puton & Reut., which has not previously been recorded in Britain, was numerous on apples in one locality. *Cnephasia wahlbomiana* var. *virgaureana*, Tr., was found damaging hops. The shoots and developing leaves were spun together, and in a few cases the stems were attacked, causing the tips to die off. This Tortricid

appears to be polyphagous and might possibly become a serious pest of hops. Lettuce was severely attacked by an unidentified caterpillar.

The sawfly, *Taxonus glabratus*, Fall., caused considerable injury to apples in one locality, the larvae, which usually infest docks [*Rumex*] and other weeds, having entered the fruit for pupation. Larvae of a Bibionid, *Dilophus vulgaris*, Mg. (*febrilis*, L.), were recorded as doing extensive damage in spring to the greens on a golf course.

Peters (G.). **A short Guide to Tree Fumigation.**—Cr. 8vo, 126 pp., 66 figs. Frankfort-on-Main, 1931.

In this booklet the author has compiled the chief facts regarding tent fumigation of *Citrus*, with special reference to the newest methods of using calcium cyanide, particularly an almost pure form of it prepared in tablets by a German firm, for which a table of dosages is given. Formulae for determining the cubic capacity of tents are also given, and apparatus for measuring the concentration of gas is described. The chemical properties of calcium cyanide and the generation of the gas for fumigation are explained, with notes on the analysis of cyanogen compounds. Brief reference is made to the use of calcium cyanide in greenhouse fumigation, etc. Other sections deal with the biology of the more important Coccid pests of *Citrus* and the effect of hydrocyanic acid on plants.

Reh (L.) & others. Sorauer: **Handbuch der Pflanzenkrankheiten. Bd. V. (Tierische Schädlinge an Nutzpflanzen. II. Teil) Zweite Hälfte (Bogen 27-Schluss).** [Sorauer. Text-book of Plant Diseases. Vol. V (Animal Pests of Economic Plants. Part 2), 2nd Half.]—Roy. 8vo, pp. xvi+417–1032, 283 figs. Berlin, P. Parey, 1931. Price, paper, *M.*51.

This is the second half of the second part of the fourth edition of Sorauer's text-book [*cf. R.A.E.*, A, xiii, 163; xvii, 256]. The section on Hymenoptera is concluded in 4 pages; 330 deal with the Rhynchota, and the remainder with reptiles, birds and mammals, except for a chapter of 41 pages by Dr. Walther Trappmann on the materials and methods adopted against pests. A table of contents and index for the whole of the second part are included.

Schimitschek (E.). **Forstentomologische Untersuchungen aus dem Gebiete von Lunz. I. Standortsklima und Kleinklima in ihren Beziehungen zum Entwicklungsablauf und zur Mortalität von Insekten.** [Forest Entomology Investigations in the Lunz District. I. Local Climate and Micro-climate in their Relation to the Course of Development and Mortality of Insects.]—*Z. angew. Ent.*, xviii, no. 3, pp. 460–491, 11 figs. Berlin, 1931.

The effect of local climate and micro-climate on insect development and mortality was studied on *Ips typographus*, L., and to a less degree on *I. amitinus*, Eichh., in the district of Lunz, Austria, at various points between 2,000 and 5,000 ft., by means of trap logs of spruce and larch felled in May 1930 and fitted with thermometers. The flight period of both species began between 27th May and 2nd June, a week with more hours above 12° C. [53·6° F.] than below and in which temperatures

of 20° C. [68° F.] were reached. Measurements of the cambium temperatures in different parts of the logs showed that the females avoid the warmest part in boring the brood mines. Examinations made on 20th June showed that young and half-grown larvae of *I. typographus* had been killed by high cambium temperatures of 42–52° C. [107·6°–125·6° F.] on the upper side of the logs. The maximum cambium temperatures exceeded the maximum air temperatures in the same place by 4–20° C. [7·2–36° F.]. Long continued high relative atmospheric humidity at about 2,500 ft. was responsible for a great mortality of the larvae and pupae on the underside of the logs. No infection by fungi or bacteria was observed, and it was only at the end of September that a mycelium of *Schizophyllum commune* was found on the adults and pupae. *I. typographus* occurred alone at the lower altitudes and was only found in felled spruce, felled larch and standing ringed spruce being untouched. In the logs at about 3,600 ft. *I. amitinus* was also present, increasing at 4,000 ft. and occurring alone at about 4,800 ft. At 3,600 and 4,000 ft. the development of both species coincided. The most rapid development (51 days) occurred at a low lying point and in broods that had survived the heaviest mortality, *i.e.*, in the upper side of the logs. Development was slowest in an equable stand climate on the under side of the logs with cambium temperatures exceeding the air temperatures only slightly owing to lack of sunshine.

Except in the presence of extensive windfalls and of bad forestry conditions, widespread outbreaks of bark-beetles are rare in the exploitation of forests at high altitudes. The above data indicate provisionally that this is due to the changes in climatic conditions in the mountain forest zone, the mortality in certain places resulting from high relative atmospheric humidity, and high cambium temperatures, the short vegetation period and late flight period, and the frequent falls in night temperatures.

The absence of Braconids everywhere except at one point at about 2,600 ft. was remarkable and confirms the view that they require warm and dry districts. Chalcidoids were very common, especially *Pteromalus* (*Rhopalicus*) *suspensus*, Ratz., and *Rhoptrocerus xylophagorum*, Ratz., and in the two places with high relative humidity parasitism amounted to 14–72 per cent. of the Scolytids that had survived the mortality due to moisture. A table is given showing the parasites and predators observed at the various points and the injurious insects seen there. Though abiotic factors were more important than the parasites, it is possible that the action of the latter reduces the abundance of the Scolytids to the residual minimum.

One of the observation points (Gstettneralm) lies at about 4,000 ft. at the bottom of a deep basin. It has the lowest temperatures in Central Europe ; frost occurs at mid-summer, and in February 1930 the temperature near the ground was −48° C. [−54·4° F.]. The vegetative period is short, and the flora that of continental Lapland and North Siberia. *Rhyacionia* (*Evetria*) *turionana*, Hb., occurs on dwarf mountain pine, its abundance decreasing with the descent into the basin. Among the pines, minimum temperatures down to −11·2° C. [11·84° F.] were noted between 23rd September and 11th November 1930. *Ips* (*Pityogenes*) *conjunctus*, Reitt., occurs in the dead or dying branches. The life-cycle lasts 2 years, or 1½ in the most favourable circumstances, but higher up the sides of the basin there is a 1 year life-cycle. The influence of abiotic factors is thus strikingly shown at this observation point.

SPRENGEL (L.). **Epidemiologische Forschungen über den Traubenwickler** *Clysia ambiguella* **Hübn. und ihre Auswertung für die praktische Grossbekämpfung.** [Epidemiological Investigations on the Vine-moth, *C. ambiguella*, and their Utilisation for practical Control on a large Scale.]—*Z. angew. Ent.*, xviii, no. 3, pp. 505–530, 12 figs., 58 refs. Berlin, 1931.

In the Bavarian Rhine Palatinate vines are grown over an almost unbroken area of about 40,000 acres with an average annual temperature of 9–10·5° C. [48·2–50·9° F.]. Parasites and birds are scarce, so that weather is the sole factor regulating the abundance of the vine-moths, *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff.

The investigations described in this paper deal with the variation in abundance of *C. ambiguella*. In studies of the effect of temperature and humidity on the adults, freshly fertilised females never lived more than 5 days in constant laboratory conditions ; in the field they must live longer. Above 32° C. [89·6° F.] they all died on the first day. At 32° C. with air almost saturated with moisture they lived up to 3 days ; with less moisture they died on the first day. At 20–28° C. [68–82·4° F.] with much moisture they lived for 5 days, so that these are the most favourable conditions. At these temperatures, but with lower humidity (40–7 per cent.) they died within 3 days. Above 28° C. no eggs were laid. The optimum temperature for oviposition was between 22 and 25° C. [71·6 and 77° F.], much fewer eggs being laid between 21 and 19° C. [69·8 and 66·2° F.]. High humidity (particularly 70–90 per cent.) promoted oviposition. With favourable conditions 20 eggs on an average were laid, and as the females contained up to 60 mature eggs, it is supposed that further depositions depend on changes in temperature.

The eggs hatched in 8–9 days at 20° C., 7 at 22° C., and 6 at 25° C. Moisture had little or no effect on the duration of their development. Temperatures of 35° C. [95° F.] killed all eggs at all degrees of humidity. At 32° C. more than 66 per cent. were killed at humidities between 50 and 70 per cent., but at 70–90 per cent. humidity, more than 50 per cent. survived. At 28–30° C. [86° F.], the eggs were not affected by a marked variation in humidity between 50 and 90 per cent., and developed normally. The figures above 32° C. are of prime importance, as they explain the cases where an abundant oviposition has failed to result in injury by the larvae. The vital optimum for the eggs lies between 28 and 20° C. with a humidity of between 35 and 90 per cent. The optimum for ovipositing females is thus far more restricted and of greater importance in affecting the degree of infestation. As the number of eggs laid depends on external factors, a " development potential " calculated from the curve of duration of development and the theoretical number of eggs cannot be applied to actual conditions.

Up to about 15 years ago no reliable method of control was available, and in some years losses of up to 1–1½ million sterling were sustained. Glass bait-traps are now generally used to ascertain the abundance of the moths, the numbers in each glass being noted daily and posted up publicly, so that individual vine-growers can dust or spray before the larvae hatch. The results described in this paper show that it is possible to estimate the requirements for control on the basis of the flight of the moths and temperature records. The different cases that may occur are enumerated, and it is stated in each instance whether measures are required, and, if so, the date for application. It is evident that an outbreak can be predicted sufficiently early to allow of its effective control.

ZWÖLFER (W.). **Zur Lehre von der Bekämpfung der Schadinsekten.** [A Contribution to the Science of the Control of Insect Pests.]—*Z. angew. Ent.*, xviii, no. 3, pp. 531–536, 11 refs. Berlin, 1931.

This discussion is in some points similar to Bodenheimer's "Theoretical Considerations on the Evaluation of Control Measures" [*R.A.E.*, A, xix, 290]. The effect of a measure against a pest must be regarded as supplementing the natural factors of control already present at the place of infestation. A formula, developed from the population formula, is given for ascertaining the requisite "minimum effect value," as a knowledge of this makes it possible to judge the suitability or otherwise of a given measure, thus avoiding useless experiments. If the percentage of the pest that can be destroyed by a given measure is equal to, or greater than, the "minimum effect value," the measure in question may be regarded as promising. In cases in which this value is not reached, the formula shows how often the measure needs repeating to attain the standard. It is immaterial to what stage of the pest the measure producing the required effect is applied, provided that its application precedes the harmful stage. The nearer an outbreak approaches its peak, the greater the demands on the control measure. A measure with a low percentage of effectiveness may prove satisfactory if applied at the beginning of an outbreak. An example of this is the control in South Germany of the nun moth, *Lymantria monacha*, L., by killing the adults by hand [*cf.* xix, 702].

EIDMANN (H.). **Zur Kenntnis der Periodizität der Insektenepidemien.** [A Contribution to the Knowledge of the Periodicity of Insect Epidemics.]—*Z. angew. Ent.*, xviii, no. 3, pp. 537–567, 5 figs., 51 refs. Berlin, 1931.

This is an attempt to establish, from historical and statistical records, a basis for the prediction over several decades of outbreaks of the chief German forest pests in the light of their regular periodicity. Such a method can, at most, only indicate the periods when there is a danger of serious outbreaks. Further data are needed to show if it can be applied to individual outbreaks and restricted areas. A survey is given of the outbreaks in Germany between 1800 and 1925 of *Lymantria monacha*, L., *Dendrolimus pini*, L., *Panolis flammea*, Schiff. (*piniperda*, Panz.), *Bupalus piniarius*, L., and *Diprion* (*Lophyrus*) *pini*, L. In the case of *P. flammea* non-German records are included. The survey shows a marked and continuous increase in outbreaks in recent decades owing to more intensive forestry, inadequacy of records early in the nineteenth century, etc. There has, however, been a decrease of outbreaks of *Dendrolimus pini* as a result of the successful use of adhesive bands since 1865.

The outbreaks are not casually distributed throughout the 125 years examined, for all the pests had approximately contemporaneous periods of great increase and similar periods of less increase. There thus result "periods of injury" with an average duration of 12 years. In the number of outbreaks within such a period there is a slow increase to a maximum, followed by a rapid decrease to the next minimum. On an average every third maximum is particularly high; the interval between these peaks is 30 years on an average. The maxima (with a few exceptions) show considerable coincidence with the maxima of the frequency of sunspots, while the minima (owing to the different

relative position of the maxima and minima to each other) are displaced, the sunspot minima being usually some years later than the minima of the number of pest outbreaks. Meteorological literature shows that terrestrial climate has a periodicity parallel to the frequency of sunspots. In Germany a sunspot maximum is accompanied by a temperature maximum, or precedes it by a short interval; this is followed by a fall in temperature. Furthermore, a minimum of rainfall precedes the sunspot maximum by 2–3 years. Sunspot minima are characterised by relatively cool and wet years. It is quite possible that the " periods of injury " are fixed by the climatic periods dependent on the frequency of sunspots.

Friederichs (K.). **Zur Oekologie des Kohlweisslings** (*Pieris brassicae*). [A Contribution to the Ecology of the Cabbage White, *P. brassicae*.] —*Z. angew. Ent.*, xviii, no. 3, pp. 568–581, 5 figs. Berlin, 1931.

In the summer of 1929 *Pieris brassicae*, L., caused serious injury to kohl-rabi in the sandy coastal region of Mecklenburg. The edges of the fields were often preferred for oviposition, especially if they were protected and sunny. Oviposition was more intense in the smaller fields, owing to the fact that individual plants are more severely infested when only a few are present, and also perhaps because in a large field there is a lack of blossoms as food for the adults.

In this region the chief limiting factor is normally *Entomophthora sphaerosperma*, which destroys the larvae in September, but in 1929 the weather was more of a continental type than usual and the fungus was absent. The pupae, however, were reduced to a minimum by *Pteromalus puparum*, L., more than one generation of which parasitises a generation of *P. brassicae*. The number of rainy days in September governs the way in which the outbreak is checked. The various factors involved and their complicated interrelationship are discussed. In winter in this region *Apanteles* [*glomeratus*, L.] always occurs in very much larger numbers than its host, and in 1929 the same applied to *Pteromalus*. The numbers of *P. brassicae* are thus very greatly reduced and are then further decreased by winter mortality and birds. Though birds destroy the parasites as well, the latter are still in excess in spring. In 1929 the average percentage of parasitism of the pupae of the second generation of *P. brassicae* by *Pteromalus* was 80·85, and of *P. rapae*, L., 87·65. Pupae of *P. brassicae* were found in a forest about 30 yards from the edge, which in turn was about 80 yards from the nearest field. The larvae must therefore have travelled this distance, and some pupae were found in the crowns of the pines. In experiments in 1930 savoy cabbage was preferred to white cabbage, and red cabbage came last, though serious injury to red cabbage has been reported. Other food-plants are nasturtium (*Tropaeolum majus*) and horse-radish (*Cochlearia armoracia*), the latter being occasionally attacked by larvae that have defoliated adjacent cabbage.

Blunck (H.). **Ueber die Parasiten der Rohrglanzgrasgallmücke *Mayetiola phalaris* Barnes.** [On the Parasites of *M. phalaris*.]— *Z. angew. Ent.*, xviii, no. 3, pp. 582–589. Berlin, 1931.

For about 10 years at Randowbruch, Pomerania, *Phalaris arundinacea* has been grown unmixed on a large scale for seed production. In 1925

infestation by the gall-midge, *Mayetiola phalaris*, Barnes [*R.A.E.*, A, xvi, 493] caused severe losses. In the laboratory in 1926 the adults emerged between 8th April and 7th May, chiefly at night. Both sexes emerged about the same time. Six newly-emerged females contained 518, 399, 374, 361, 289, and 121 eggs almost ready for deposition. Oviposition began in the first fortnight in May, the egg-batches on the leaves of *Phalaris* being similar to those of *M. destructor*. Of 524 pupae examined in March 1926, only 3·8 per cent. contained healthy individuals, and 27·5 per cent. were definitely parasitised. Parasites obtained from them were the Platygasterids, *Trichacis remulus*, Wlk., and another species, the identity of which is uncertain, the Ichneumonid, *Phygadeuon monodon*, Thoms., the Miscogasterid, *Semiotellus destructor*, Say, the Pteromalid, *Meraporus graminicola*, Wlk., and the Eulophids, *Entedon metallicus*, Nees, and *Tetrastichus rileyi*, Lind. Notes are given on the dates on which some of the parasites appeared.

Rhumbler (L.). **Ueber das Schicksal der von der Buchenrindenwollaus (*Cryptococcus fagi* Bsp.) befallenen Buchen.** [On the Fate of Beech Trees infested by *C. fagi*.]—*Z. angew. Ent.*, xviii, no. 3, pp. 590–614, 6 figs., 1 pl., 13 refs. Berlin, 1931.

This paper is supplementary to one already noticed [*R.A.E.*, A, ii, 571] and discusses the fate of beech trees infested by *Cryptococcus fagi*, Bär. The investigations were made from about 1904 to 1925, the outbreak ceasing in the latter year owing to unknown causes. The area of chief infestation was between 51° 15′ and 52° 15′ N. and between 7° 20′ and 11° 30′ E. An outbreak begins when the few individuals causing the normal harmless infestation multiply on some of the beech trees until a dangerous infestation ensues. This is usually the first visible starting point of a series of diseases that may kill even the strongest trees in from 3 to 15 or more years. The course and characters of this destruction are discussed, with an account of the methods adopted for following its development. Assuming the same conditions to be present in future dangerous infestations, it may be accepted that from 15 to 20 per cent. of the heavily infested trees in a stand will be killed.

Eckstein (K.) & Butovitsch (V.). **Beitrag zur Kenntnis der Fauna der Kiefernkahlschläge.** [A Contribution to the Knowledge of the Fauna of clear-felled Areas in Pine Forests.]—*Z. angew. Ent.*, xviii, no. 3, pp. 615–633, 9 refs. Berlin, 1931.

For the purpose of determining the fauna in clear-felled areas of pine forests [*cf. R.A.E.*, A, xix, 703] use was made at Melchow (Eberswalde) of the trenches of the successful type originated there against *Hylobius abietis*, L. [xix, 663]. The total length of the trenches examined was about 1,500 yards, and the collections were made weekly from 17th April to 27th September 1930. A table, covering 8 pages and arranged according to species, shows the number of insects taken and the dates of capture. Excluding *H. abietis*,

176 species of Coleoptera with a total of 33,008 individuals represent the very great majority of the trench fauna, Carabids being the family with the largest number of species and individuals. These beetles were seldom found preying on *H. abietis*, which apparently is attacked only in the absence of other food. *H. abietis* was already present on 17th April, the few individuals then observed increasing to thousands until the maximum was reached at the end of April, when there was a gradual decrease with fluctuations due to temperature. Early in July the minimum was reached. In the second half of July and early in August there was a temporary increase, owing to the appearance of young adults.

VON VIETINGHOFF-RIESCH (A. Frhr.). **Erlebnisse mit Forstinsekten als Lausitzer Revierverwalter 1923–1930.** [Experiences with Forest Insects as a Forest Ranger in Saxon Lusatia in 1923–1930.] —*Z. angew. Ent.*, xviii, no. 3, pp. 634–653, 9 figs. Berlin, 1931.

These notes on experiences in the author's forests in Saxony include an account of an infestation of pines by *Diprion* (*Lophyrus*) *pini*, L., which lasted about twelve months up to August 1929 when it ceased owing to intense parasitism by *Exenterus marginatorius*, F. It was followed by an outbreak of the pine moth, *Bupalus piniarius*, L., which in turn was checked by parasites and other causes. Owing to these infestations, about 88 thousand cubic feet of timber had to be felled, though this was obtained in perfect condition.

DINGLER (M.). **Rüsselkäferstudien. III. Brutgruben-Ergebnisse.** [Studies on Weevils. III. Results from Breeding Trenches.]— *Z. angew. Ent.*, xviii, no. 3, pp. 654–671. Berlin, 1931.

An account is given of further studies on the generations of the pine weevil, *Hylobius abietis*, L. [*cf. R.A.E.*, A, xiii, 63, 201 ; xiv, 416], based on data obtained from Grohmann trap breeding trenches [ii, 325] in forests near Giessen in 1927, 1929, and 1930. It was found that the larva can hibernate twice. The abnormally high temperatures in June 1930 caused the hibernated larvae of 1929 to develop so rapidly that the adults expected in the spring of 1931 emerged and began to reproduce in August 1930. Three types of generation can be produced from eggs deposited in spring, according to whether the sum of warmth in the year is normal or higher, *viz.*, a generation lasting 2 years from spring to spring, both larva and adult hibernating ; a 1 year generation from spring to spring, the adult hibernating ; and a generation lasting $1\frac{1}{4}$ years from spring to summer, the larva hibernating. As weevils emerging in late summer deposit eggs, the following additional types of generation occur : a $1\frac{3}{4}$ year generation from summer to spring, both larva and adult hibernating ; a $\frac{3}{4}$ year generation from summer to spring, the adult hibernating ; and a 1 year generation from summer to summer, the larva hibernating. A generation in which there was no hibernation has not been observed. The optimum situation for the larvae was at a depth between 12 and

24 inches, 72 per cent. of all the pupae being found there. Brief reference is made to many other insects, chiefly Diptera and Scolytids, found on or in the billets.

Trägårdh (I.). **Zwei forstentomologisch wichtige Fliegen.** [Two Flies of Importance in Forest Entomology.]—*Z. angew. Ent.*, xviii, no. 3, pp. 672–690, 30 figs., 14 refs. Berlin, 1931.

Leucopis obscura, Hal., the literature on which is reviewed, with descriptions of the larva, pupa, and adults, was first observed in Sweden in 1919 on silver-fir [*Abies*] infested by *Chermes piceae*, Ratz., of which it was a very effective parasite.

The only Dipterous larva previously known to the author as definitely attacking the larvae of *Hylobius abietis*, L., was the Dolichopodid, *Medeterus signaticornis*, Lw. [*R.A.E.*, A, iii, 147], but in July 1920 larvae of *Megaselia plurispinulosa*, Zett., were found in Sweden in the weevil larvae under the bark of spruce logs in Grohmann traps [ii, 325]. As a rule, 8–10 larvae of this Phorid occurred in each host, of which often only the cuticle remained. In one instance, of 74 larvae of *H. abietis*, 54 per cent. were parasitised by it, and 8 per cent. by fungi. It is suggested that the female fly seeks the weevil larva, and that it is immaterial whether the latter is healthy or diseased, as its position under the bark precludes any attempt to prevent attack. The larva of *M. plurispinulosa* is described at length, and the formation of its mouth parts, which differ from those of all other Phorids, seems to suggest that it is a true parasite of *H. abietis*.

Andres (A.). **Beitrag zur Kenntnis ägyptischer Bostrychiden.** [A Contribution to the Knowledge of Egyptian Bostrychids.]—*Z. angew. Ent.*, xviii, no. 3, pp. 691–697, 4 figs., 1 col. pl. Berlin, 1931.

Poinciana regia is now grown in Egypt as a shade and ornamental tree in place of *Albizzia lebek* owing to the infestation of the latter by *Phenacoccus* (*Pseudococcus*) *hirsutus*, Green. The larvae of the Buprestid, *Chrysobothris affinis*, F., occur in the larger branches, but are important only in so far as they weaken the tree and lay it open to attack by other pests, such as the Bostrychid, *Sinoxylon ceratoniae*, L., which is common in the Delta. *Poinciana* trees were observed in Upper Egypt that had been riddled by the latter, but the beetles themselves had almost completely disappeared, owing to the activities of the predacious Histerid, *Teretrius kraatzi*, Mars., which occurred in large numbers in the mines. A few examples of *T. pulex*, Fairm., were also found in them, as well as other Coleoptera, including the Tenebrionid, *Latheticus oryzae*, Waterh., which in Egypt occurs under bark and in cereals and millers' products. Two other species of *Sinoxylon*, *S. subretusum*, Lesne, and *S. senegalense*, Karsch, occur in Egypt, but are rare. In Senegambia the latter infests felled gum-producing trees and the woodwork in huts.

Another Bostrychid, *Phonapate frontalis*, F., occurs in Egypt locally at Edku, where of recent years there has been a great increase of the injury due to its boring into the branches of date palms [*Phoenix dactylifera*]. The larvae are found in dried palm fronds used in hut construction. Further investigation is needed to ascertain if only maturation feeding occurs in the date palm.

PAPERS NOTICED BY TITLE ONLY.

BODENHEIMER (F. S.). **Zur Kenntnis der paläarktischen *Kermes*-Arten (Rhy. Cocc.).** [To the Knowledge of Palaearctic *Kermes*, with list and characters of species, including two new ones.]—*Konowia*, x, pt. 4, pp. 241–247, 3 figs., 1 ref. Vienna, 1st December 1931.

MARTINI (E.). **Zur Terminologie in der Lehre vom Massenwechsel der Organismen.** [On the Terminology used in the Science of the Variation of Abundance in Organisms.]—*Z. angew. Ent.*, xviii, no. 3, pp. 440–459, 29 refs. Berlin, 1931.

BIBBY (F. F.). **Coccoids collected on wild Plants in semi-arid Regions of Texas and Mexico (Homoptera).**—*Bull. Brooklyn Ent. Soc.*, xxvi, no. 4, pp. 189–194, 9 refs. Lancaster, Pa., October 1931.

ALDRICH (J. M.). **Notes on Francis Walker's Types of North American Flies of the Family Tachinidae.**—*Proc. U.S. Nat. Mus.*, lxxx, art. 10, no. 2910, 16 pp., 61 refs. Washington, D.C., 1931.

DOBZHANSKY (T.). **The North American Beetles of the Genus *Coccinella*** [with key].—*Proc. U.S. Nat. Mus.*, lxxx, art. 4, no. 2904, 32 pp., 30 figs., 15 refs. Washington, D.C., 1931.

SMITH (C. E.) & ALLEN (N.). **Sex Differentiation of the Spotted Cucumber Beetle** [*Diabrotica duodecimpunctata*, F.].—*J. Econ. Ent.*, xxiv, no. 5, pp. 1077–1079. Geneva, N.Y., October 1931.

QUAINTANCE (A. L.) & SIEGLER (E. H.). **The more important Apple Insects.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 1270 revd., 105 pp., 196 figs. Washington, D.C., June 1931. [*Cf. R.A.E.*, A, xi, 259.]

LIGHT (S. F.). **The Termites of Nevada.**—*Pan-Pacific Ent.*, vii, no. 1, pp. 5–9. San Francisco, Cal., July 1931.

NEWCOMER (E. J.) & CARTER (R. H.). **Fluorine Compounds as Substitutes for Lead Arsenate in the Control of the Codling Moth** [*Cydia pomonella*, L.].—*Proc. Washington St. Hort. Ass.*, xxvi (1930), pp. 73–76. [Olympia, Wash., 1931.] [*Cf. R.A.E.*, A, xix, 366.]

ARNDT (C. H.) & DOZIER (H. L.). **The Haitian Coffee Tree Cricket** [*Chremon repentinus*, Rehn.].—*J. Dept. Agric. Puerto Rico*, xv, no. 3, pp. 325–335, 6 figs. Rio Piedras, P.R., 1931. [Translation from the French, *R.A.E.*, A, xix, 417.]

SJÖSTEDT (Y.). **Studien über *Valanga*-Formen (Orth. Acrid.) aus dem Indo-Malayischen Archipel und Oceanien.**—*Ark. Zool.*, 23A, no. 4, 26 pp., 7 figs. Stockholm, 1931.

TAKEYA (C.). **Some Tingitidae of the Japanese Empire.** [In Japanese, with descriptions of new species in English, including *Stephanitis fasciicarina* on *Cinnamomum camphora* (camphor) in Japan.]—*Mushi* (*J. Fukuoka Ent. Soc.*), iv, pp. 65–84, 3 pls. Fukuoka, Japan, 1931.

TAKAHASHI (R.). **Some Formosan Whiteflies** [2 new genera and 5 new species].—*J. Soc. Trop. Agric.*, iii, no. 3, pp. 218–224, 5 figs. Taihoku, Formosa, October 1931.

TAKAHASHI (R.). **Some Whiteflies of Formosa (2)** [3 new species].—*Trans. Nat. Hist. Soc. Formosa*, xxi, no. 116, pp. 261–265, 3 figs. Taihoku, Formosa, October 1931.

STELLWAAG (F.). **Giftigkeit und Giftwert der Insecticide. vii. Teil : Grundlagen und besondere Methodik der Bestimmung des "Giftwertes" im "Serienversuch."** [The Toxicity and toxic Value of Insecticides. Part V. The Bases and special Methods for determining the toxic Value of an Insecticide by Experiment with a Series of Insects.]—*Z. angew. Ent.*, xviii, no. 3, pp. 698–725, 5 figs., 36 refs. Berlin, 1931.

Tests with series of insects of a given species are designed to ascertain the toxic value of preparations containing various components, and compare the effects of various insecticides (*i.e.*, the materials as applied), pure poisons, and carriers used with the poisons. As compared with tests in which an exact amount of poison is given to an individual insect [*R.A.E.*, A, xix, 698], the "series test" considers primarily the total effect, the symptoms of poisoning, and the repellent action. It is especially useful for testing poisons combined with other substances. The requisite technique is described. From 30 to 100 healthy individuals of similar age are used, and the series of tests must be repeated. To ensure equal feeding by the various individuals, they are previously starved. Tests with an equal amount of arsenic in various combinations with other substances showed that it is not the poison itself that is important but the combination in which it occurs. In experiments with silkworms [*Bombyx mori*, L.], the arsenite and arsenate of sodium were used with an inert carrier, and the toxicity of the arsenate was somewhat greater than that of the arsenite. On the whole, they may be considered equal. Some tests showed that Paris green and lead arsenate decrease in toxicity when mixed with fungicides. The repellent action of poisons was evidenced by the fact that a material containing 15 per cent. of sodium arsenite or arsenate was less effective than one with only 10 per cent. of either of these poisons.

ECKSTEIN (F.). **Ueber die Verwendung von Ködermitteln zur Schädlingsbekämpfung.** [On the Use of Baits in Insect Control.]—*Z. angew. Ent.*, xviii, no. 3, pp. 726–743, 22 refs. Berlin, 1931.

This is a survey, largely from the literature, and discussion of the employment against insect pests of baits, either in traps, or as poisons used in liquid form in containers or as sprays, or in mixtures distributed by scattering. The author found that the asparagus fly, *Platyparea poeciloptera*, Schr., is guided by sight, sticks shaped like asparagus shoots attracting it to the almost total neglect of pieces of wood of other shapes, so that even with baits acting on the olfactory organs the colour of the material may be of importance in some cases. He also found that water containing iron rendered ineffective a poison bait for the larvae of *Tipula oleracea*, L., and *T. paludosa*, Mg., whereas 100 per cent. mortality was obtained with the same bait mixed with ordinary water. As regards the actual poison, fluorine compounds repel less than arsenicals, and this more than counteracts their lower toxicity. Paris green produced only 70 per cent. of the mortality obtained with a fluoride in an otherwise similar bait used against larvae of *Euxoa* (*Agrotis*) *segetum*, Schiff.

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Muesebeck (C. F. W.). *Monodontomerus aereus* **Walker, both a primary and a secondary Parasite of the Brown-tail Moth and the Gipsy Moth.**—*J. Agric. Res.*, xliii, no. 5, pp. 445–460, 3 figs., 13 refs. Washington, D.C., 1st September 1931.

The following is largely taken from the author's summary: All stages of the Torymid, *Monodontomerus aereus*, Wlk., are described, and its geographical distribution and the literature on it are briefly reviewed. It was introduced into the United States from Europe in 1906, against *Nygmia phaeorrhoea*, Don., and *Porthetria dispar*, L. Normally, however, it is an ectoparasitic hyperparasite, and is sometimes a serious enemy of certain species of Tachinids. It has been reared as a direct hyperparasite from cocoons or puparia of many Hymenopterous and Dipterous primary parasites of both *N. phaeorrhoea* and *P. dispar*, and has also been obtained from the pupae of certain Lepidoptera, either as a primary or secondary parasite. In the laboratory it has been found to develop occasionally as an internal parasite in fresh Tachinid puparia and in the pupae of *N. phaeorrhoea* and *P. dispar*.

M. aereus hibernates in the adult stage in the winter webs of *N. phaeorrhoea*, only females surviving the winter. Emergence from hibernation occurs in April and May, but general oviposition probably does not begin until June. The eggs are deposited, 1 to 4 at each insertion of the ovipositor, externally on the host within the cocoon or puparium, and internally in the case of living Lepidopterous pupae, or very fresh Tachinid puparia. From 172 to 352 eggs have been laid by isolated females ovipositing over periods ranging from 43 to 56 days. The larvae usually hatch in 48–72 hours, and become full-grown in 4 or 4½ days, but do not pupate until several days later. The pupal stage, which is passed in the host envelope, lasts 9 or 10 days. The life-cycle from egg to adult averaged 22 days. Of 3,609 adults obtained, 61·5 per cent. were females. Mating frequently occurs before emergence from the host. Normally one generation, and occasionally a partial second, occurs during the year, about 11 months being passed in the adult stage. The females often feed at punctures made by the ovipositor. They may enter hibernation in early August, but emerge occasionally to feed until late autumn. In general *M. aereus* is probably not a hyperparasite of sufficient importance to cause much concern, but under conditions favouring successful hibernation and reproduction it may locally become a serious enemy of Tachinids that form their puparia in the cocoons of their hosts, and may also reduce the effectiveness of certain Hymenopterous parasites.

Ginsburg (J. M.). **Penetration of Petroleum Oils into Plant Tissue.**—*J. Agric. Res.*, xliii, no. 5, pp. 469–474, 5 refs. Washington, D.C., 1st September 1931.

The following is the author's summary:—Refined petroleum oils of various viscosities, stained red with an oil-soluble dye, were applied on the upper and lower surfaces of leaves of apple, peach and tomato plants. The time it took for the oil to penetrate into the leaf tissue was observed. The same oils were also tested on apple twigs. The following conclusions can be drawn from the results obtained: All the various oils tested penetrated through the under surface of the

leaf, presumably through the stomata, the rate of penetration varying inversely with the viscosity of the oil [*cf. R.A.E.*, A, xix, 359]. Only oils of low viscosity penetrated through the upper surface of the leaf. Oils of higher viscosities did not penetrate at all, or only slightly so, through the upper surfaces of the leaves. Wherever oil penetrated into the leaf, injury followed shortly after. Penetration of emulsified oils is much slower and is accompanied by less injury than that of pure oils. Petroleum oils are absorbed and conducted by the vascular bundles of apple twigs, the rate of conduction varying indirectly with the viscosity of the oil. The viscous oils either do not penetrate at all, or only to a very slight extent, through the outer cork of the twig. Only oils of very low viscosities exhibited appreciable penetration through the cork and into the cambium of the apple twig. Penetration of oil into leaf tissue and absorption into apple twigs vary directly with the concentration of the oil.

Report of the Virgin Islands Agricultural Experiment Station, St. Croix, 1930.—19 pp., 11 figs. Washington, D.C., U.S. Dept. Agric., 1931.

C. L. Horn reports that the results of experiments in the Virgin Islands against *Asterolecanium pustulans*, Ckll., on fig trees indicate that it may be controlled by a 2 per cent. paraffin oil emulsion applied at intervals of 60 days. M. S. Baker states that on resumption of experiments with cotton after a close season of 2 years, the larvae of *Platyedra* (*Pectinophora*) *gossypiella*, Saund., were found on the first blooms that opened, and about 15 per cent. of the bolls were infested. A plot of five rows that had been sprayed at regular intervals with Bordeaux mixture in which lead arsenate had been incorporated yielded 159·9 lb. more seed cotton than an untreated one. The Bordeaux mixture was included in the hope that it would act as a repellent.

Leonard (M. D.) & Mills (A. S.). **Observations on the Bean Lace-bug in Porto Rico.**— *J. Dept. Agric. Puerto Rico*, xv, no. 3, pp. 309–323, 1 fig., 2 pls., 44 refs. Rio Piedras, P.R., 1931.

Corythuca gossypii, F., all stages of which are described with notes on its distribution and food-plants, occurs in all parts of Porto Rico at the lower altitudes, but has not been found higher than about 1,300 ft. Infestation was discovered on lima beans [*Phaseolus lunatus*] in four localities in 1930, Porto Rico apparently being the only country where this crop is attacked. The damage is more severe than that caused to other plants, such as cotton, papaya [*Carica papaya*], soursop (*Anona muricata*) and *Citrus*. The nymphs and adults feed on the lower surface of the leaves, causing a whitish discolouration on the upper one. Severe injury, when the leaves wither and fall, has only been observed on lima beans and on four trees of *Anona diversifolia*.

Breeding of *C. gossypii* occurs on its various food-plants throughout the year, a generation apparently occupying not more than about three weeks. Many eggs are laid on the lower surface of the leaf and are partly or wholly inserted into the tissue of the midrib or larger veins. The nymphs are attacked by those of a Reduviid, *Zelus nugax*, Stål. The damage caused has apparently never been

of sufficient importance to warrant control measures except on lima beans. A review of the literature on the use of sprays for the control of Tingids shows that nicotine sulphate is comparatively ineffective, but good results have been obtained with soap [*R.A.E.*, A, iii, 576]. The authors found that 1 lb. Octagon soap to 8 U.S. gals. water gave 100 per cent. mortality of the nymphs and 95 per cent. of the adults. The lower surface of the leaves should be thoroughly treated by means of a fine driving mist under comparatively high pressure.

STRAND (A. L.). **Measuring the Toxicity of Insect Fumigants.**—*Indust. Engng. Chem.*, Anal. edn., ii, no. 1, p. 4 (reprint 11 pp.), 25 refs. Easton, Pa., 15th January 1930. [Recd. November 1931.]

The following is the author's abstract: A review of the methods used for establishing the relative toxicities of insect fumigants is presented. It is shown that the greatest error in these methods rises from the attempt to determine minimum lethal concentrations. A method for measuring relative values by comparing concentrations which kill 50 per cent. of the test insects in a period of 5 hours has been investigated. These concentrations may be designated as the 5-hour median lethal concentrations. The method appears to possess greater possibilities for accurate work on fumigants than those now in general use.

MACGILL (E. I.). **The Biology of Thysanoptera with Reference to the Cotton Plant. vii. The Relation between Temperature and Humidity and the Life Cycle.**—*Ann. Appl. Biol.*, xviii, no. 4, pp. 574–583, 3 diag., 6 refs. Cambridge, November 1931.

A series of experiments carried out in 1926 to determine the effect of atmospheric humidity on the development of *Thrips tabaci*, Lind. [*R.A.E.*, A, xvi, 149] were repeated in a more exact manner, the temperature being controlled by a multiple temperature incubator and the degree of relative humidity by a series of saturated solutions of certain salts. The thrips larvae were confined on pieces of cotton leaf in small tubes. It is concluded from the results of these experiments, the technique of which is described, that the degree of relative humidity has little or no effect on the length of the life-cycle of *T. tabaci*, although it has a marked effect on the mortality of the immature stages. The optimum temperature for the development of the larvae tends to rise with an increase in the atmospheric humidity, and at high temperatures a correspondingly high degree of humidity is necessary for the survival of the thrips. The highest temperature at which adults were obtained at any humidity was 39° C. [102·2° F.], and the lowest 9° C. [48·2° F.]; larvae reached the prepupal stage at a temperature as low as 5° C. [41° F.]. At 28° C. [82·4° F.] and 75 per cent. relative humidity 55 per cent. of the larvae became mature, a much higher percentage than at any other humidity. Temperatures of 16–25° C. [60·8–77° F.] are the most generally favourable, and relative humidities of 85 and 75 per cent. give optimum conditions at almost all temperatures, with 66 per cent. nearly as favourable. At 100 and 30 per cent., conditions are much less suitable for the survival of the larvae, though the thrips are more able to withstand a saturated than a dry atmosphere.

Data of the time occupied by the prepupal and pupal stages of *T. tabaci* at constant humidities show a considerable difference (10–15 days) between the lengths of these stages at low temperatures (9–11° C. [48·2–51·8° F.]) and high ones (34–39° C. [93·2–102·2° F.]), but the curves for different humidities are all similar. The shortest time spent in the prepupal stage was less than 24 hours at 35–40° C. [95–104° F.], and between 13 and 21° C. [55·4–69·8° F.] prepupal periods of 4–6 days were common. A pupal stage of 2 days was observed at 17° C. [62·6° F.], but 8–9 days was the usual pupal period at this temperature; the longest one was 15 days, at 13° C. In another series of experiments, 7 pupae at 7° C. [44·6° F.] took 23–29 days before producing adults, and one prepupa at 6° C. [42·8° F.] required 26 days before it reached the pupal stage, although it never matured.

An apparent acceleration of development by low humidities combined with high temperatures is due in the case of *T. tabaci* to the fact that those thrips that do not transform quickly usually die before they can transform, thus shortening the average length of the prepupal and pupal stages, whereas if the degree of relative humidity is higher, more of the thrips survive and the average length of these stages is increased. It has been stated in a paper previously noticed [*R.A.E.*, A, xiii, 251] that high humidity and low temperature retard the development of *Myzus houghtonensis*, Troop, but from the present experiments it appears that this conclusion does not hold good for Thysanoptera.

TATTERSFIELD (F.). **Pyrethrum Flowers. A quantitative Study of their Development.**—*Ann. Appl. Biol.*, xviii, no. 4, pp. 602–635, 1 pl., 9 diag., 8 refs. Cambridge, November 1931.

An account is given of an investigation undertaken to follow the development of flowers of pyrethrum (*Chrysanthemum cinerariaefolium*) and to ascertain the way in which the pyrethrin content varies with the degree of development of the flowers and from plant to plant on the same soil. No previous systematic attempt had apparently been made to define the categories into which pyrethrum flowers have hitherto been separated according to the degree of openness of the flower head, and doubt still exists as to whether these distinctions refer to the flowers immediately after harvesting or after being subjected to drying. There seems little doubt that the yield of pyrethrins as well as of flowers is at a maximum when they are at the fully opened stage in the field. There is, however, a period during which the disk florets of the open inflorescence themselves are progressively opening, and it would appear that the extent to which this has happened determines the appearance of the flower when dry. As trade definitions appear to be based on the external characteristics of dried and withered flowers, an attempt has been made by photographing heads immediately after harvesting and again when completely dry to ascertain how their external appearance changes in the process of drying, but the categories of maturity set forth in connection with the experiments refer only to fresh flowers.

The following is taken from the author's summary: Flowers were harvested each week over a period of 8½ weeks beginning 28th May 1929 from a dozen pyrethrum plants selected at random from a bed of seedlings planted at Harpenden in July 1928, which had weathered

the severe winter 1928–1929, the flower heads ranging from the small bud stage in the first week to the overblown stage in the last week. The categories into which the flowers were divided to indicate maturity are defined and illustrated. The yield in numbers and weight of heads per plant, the diameters of the receptacles and the content of pyrethrin I and II were determined. There was a considerable amount of variation in all these factors in the flowers from different plants. There appears to be a quantitative development of the active principles in the flower heads from the small bud stage up to the time of maturity of the flowers, which more than keeps pace with the increase in the weight of the flowers. Thus the content of the pyrethrins, both relatively and absolutely, rises to a maximum at the maturity of the flowers. The mean percentage content of pyrethrins fell after pollination and the fading of the flowers; this corresponds with the rapid increase in weight of the heads on the formation of seed. There would thus appear to be a loss, which might be serious, both in percentage content of active principles and in yield of flowers if harvested before being fully open. There seems to be no useful purpose in leaving the flowers to reach the overblown condition.

Kuwana (I.) & Muramatsu (K.). **New Scale Insects and White Fly found upon Plants entering Japanese Ports.** [In Japanese, with descriptions in English.]—*Dobuts. Zasshi*, xliii, no. 517, pp. 647–660, 6 pls. Tokyo, 15th November 1931.

The following new species are described by Kuwana: *Chionaspis cacti* on cactus from Germany; *C. miyakoensis* on *Morus acidosa* from Miyakojima Island; *C. javanensis* on coconut palm from Batavia; *Phenacaspis dendrobii* on an orchid from Hong Kong; *Lepidosaphes cycadicola* on *Cycas revoluta* from Formosa; *Aspidiotus australiensis* on an orchid from Thursday Island; *A. biprominens* on an orchid and *A. javanensis* on a palm, both from Java; *Eriococcus shiraiwai* on cactus from Mexico; *E. kaki* on persimmon (*Diospyros kaki*) from China; and *Aleurocanthus palauensis* on an unknown plant from Palau Island.

Guest (E.). **Annual Report on Cotton (1929).**—*Mem. Dept. Agric. 'Iraq*, no. 15, 36 pp., 10 graphs, 1 diag., 4 fldg. tables, 5 refs. Baghdad, 1931.

In a section of this paper (pp. 3–4), notes are given on pests of cotton in Iraq in 1929. Towards the end of July an insect, thought to be an Aleurodid similar to the species attacking cotton in the Punjab and the Sudan [*Bemisia gossypiperda*, Misra and Lamba (*cf. R.A.E.*, A, xix, 708)], was abundant. The damage done at the experimental farm near Baghdad did not appear severe, but in country districts where cotton was generally unthinned and over-irrigated, great losses were experienced. The plants are probably weakened and so become more susceptible to adverse climate or poor cultivation. The honey-dew covering the leaves encourages the growth of fungus in damp situations where the aeration is not sufficient; the lint is also damaged. The premature opening of the bolls in August was probably due to this insect, which began to diminish in numbers in September and had almost entirely disappeared by the end of October. A kind of leaf-curl of the opening leaf-buds caused by thrips was observed early in the

season, but was subsequently outgrown. Larvae of *Earias insulana*, Boisd. (spotted bollworm) only became abundant in August, when they infested the ripening first flush bolls and young second flush flower-buds. The damage became severe from September onwards, the second flush of cotton being almost entirely lost. Following infestation by *E. insulana*, the contents of the boll is generally destroyed by a sooty black fungus (*Rhizopus nigricans*) and other organisms.

Schistocerca gregaria, Forsk. [xix, 84] damaged cotton in some districts. Fear of attack has undoubtedly restricted cotton growing for the last two years, during which time this locust has been prevalent. The larvae of *Agrotis ypsilon*, Hfn., which destroyed a considerable number of young seedlings about the middle of April, were hand-collected. Another cutworm, *Laphygma exigua*, Hb., which is a common pest of lucerne in Iraq, attacked the leaves of cotton in May, but caused little damage.

Morison (G. D.). **Advisory Entomology, 1930–31.**—*Rep. N. Scotland Coll. Agric. 1930–31*, p. 17. Aberdeen, 1931.

Acarine disease of bees [caused by *Acarapis woodi*, Rennie] has been reported from 12 counties in Scotland, 16 in England, 2 in Wales and 2 in North Ireland. The adverse weather of 1931 in many localities restricted the foraging activities of the bees, so that they were more confined to the hives, resulting in a high percentage of infestation during the latter part of the year. Frow's mixture (2 parts nitrobenzene, 2 parts petrol and 1 part safrole) kills the mites inside the tracheae of the living bees, and has proved satisfactory in a number of cases.

Smith (K. M.). **On the Composite Nature of certain Potato Virus Diseases of the Mosaic Group as revealed by the Use of Plant Indicators and selective Methods of Transmission.**—*Proc. R. Soc.*, (B) cix, no. B.762, pp. 251–267, 4 pls., 13 refs. London, 3rd November 1931.

The following is the author's summary of this paper:—Evidence is presented which proves that many of the potato virus diseases, known as mosaic, crinkle and streak, are composite in nature. A technique of virus isolation from a complex in the living plant is described. The methods of virus isolation fall into three groups, and separation was effected in the following ways: (*a*) By utilising the selective power of virus transmission exhibited by the Aphid, *Myzus persicae*, Sulz. (*b*) By the use of "plant indicators" and "plant filters." The first type of plant shows by its specific reactions when more than one virus is concerned, while passage of the complex through the second type of plant removes one or other of the component viruses of the complex to which the filter plant may be resistant. An example of a plant indicator is *Nicotiana tabacum*, while *Datura stramonium*, *Solanum dulcamara* and *Petunia* are examples of plant filters. (*c*) By taking advantage, firstly, of the difference in the lengths of the incubation periods, and, secondly, of the unequal rates of movement of the constituent viruses of a complex within the tobacco plant, at the moment of the development of primary symptoms in the young plant inoculated with the virus complex; or in the ageing plant. Two viruses, x and y, isolated from a symptomless "streak"-carrier potato, are described, and their reactions upon a selected range of host plants are given. The virus

x is transmissible by needle-scratch, but not by the agency of Aphids; the virus y is transmissible by both methods. The virus y has been shown to be an almost invariable constituent of potato virus diseases of the mosaic group; it has been isolated from twenty examples of potato diseases of this group, and has also been found alone, causing "crinkle" in several potato varieties.

HAMMOND (A. A.). **Codling Moth Control. Competitive Spraying Tests.**—*J. Dept. Agric. Vict.*, xxix, pt. 10, pp. 494–500, 1 graph. Melbourne, October 1931.

After spraying tests in Victoria previously recorded [*R.A.E.*, A, xviii, 652], it was found that some of the sprayed apples developed spot blemish in cold storage and that some pears yellowed prematurely, giving them a false appearance of being ripe and consequently detracting from their value. In further tests, therefore, the oil dosage was reduced in some cases and entirely eliminated in others. Though the experiments were not on a sufficiently large scale for definite conclusions, a reduction in the oil to ½ gal. per 80 gals. arsenical in the later sprays seems to improve both the appearance after cold storage and the keeping qualities of some varieties of apples. In some instances, however, the fruit was found to contain more than the permissible amount of residual arsenic, and this was particularly the case when a rather heavy dosage of oil was used throughout the season. The importance of the lead arsenate calyx spray was demonstrated by an excess of over 6 per cent. of infestation where this was omitted. There was no appreciable difference between the appearance of the fruit from any of the plots, and there was neither blemish on the apples nor yellowing of the pears. Although the oil-arsenate combination was more expensive, the increased cost was more than counterbalanced by the more efficient control obtained, and the effect of such control is cumulative. Apples sprayed with oil-arsenate-casein mixture or with arsenate-casein were brighter and more uniformly coloured than the others. Both the vegetable spreader contained in a proprietary arsenical mixture and a gelatine liquid spreader caused a blotch spray, which made the fruit unsightly and gave the appearance of containing more arsenic than was actually present.

Molasses bait traps were used as before in connection with these experiments, their value being shown by the capture of 850 moths, 60 per cent. of which were females, in six traps used during the period October to March.

MATHERS (W. G.). **The Biology of Canadian Barkbeetles. The seasonal History of** *Dryocoetes confusus* **Sw.**—*Canad. Ent.*, lxiii, no. 11, pp. 247–248. Orillia, Ont., November 1931.

These observations on the life-history of *Dryocoetes confusus*, Sw., in *Abies lasiocarpa* were conducted, under cage conditions, in British Columbia during 1929–30. In 1929, the young adults emerged from hibernation during the second half of June and throughout the greater part of July, and attacked fresh trees, in which they excavated first brood tunnels. Egg-laying in these was not completed until well into August, after which both sexes made feeding tunnels in which they passed the winter. The mortality among the eggs was very high, probably owing to the unusually cold wet weather, but about 10 per cent. hatched during the second half of August, and by the 21st of the

following June the overwintered young larvae had cut mines up to 25 mm. in length. The first pupa of this brood was observed on 30th July, and by 19th August new adults were to be found. They were still present in the trees on 26th August, and probably remained there until the following spring.

The parent beetles resumed their activities in the spring of 1930. The females at first constructed feeding and later second brood tunnels, in which they again oviposited. By 30th June their newly excavated extensions were up to 25 mm. long and contained from 5 to 14 eggs each. Oviposition continued until the first week in July, after which the adults entered fresh trees, in which third brood tunnels were excavated. Egg-laying in these tunnels was completed by mid-August, and although the parent beetles were still present in them at the end of the season, they probably do not survive a second winter. Larvae from eggs laid in these tunnels were first observed on 16th August, and 10 days later approximately 25 per cent. of them had hatched; in no case, however, were larvae found in tunnels less than 23 days old.

HERIOT (A. D.). **Some Notes on the Oyster Shell Scale.**—*Proc. Ent. Soc. B.C.*, no. 28, pp. 6–13. Vancouver, B.C., 1931.

On the basis of observations made during the past two years at Vernon, detailed descriptions are given of all stages of *Lepidosaphes ulmi*, L., together with notes on its biology, dealing mainly with the formation of the scale, which affords it protection during development and adult life. The activity of the crawling nymphs after leaving the parent scale appears to be largely dependent on temperature. Newly emerged nymphs that were comatose in the laboratory at 64° F., became active when taken into the sunshine at 85° F. The brief duration of the crawling period [*cf. R.A.E.*, A, xiii, 569], however, would seldom, if ever, admit of 100 per cent. control of the scale. In 1930, the eggs started to hatch on 16th May, and examination on 23rd June showed the presence of newly-emerged nymphs and a few unhatched eggs. In the case of the short fruit spurs of apple, the distance the nymphs are able to crawl need not be great in order to cause injury, and it is possible that the effect of a dormant spray may be such as to drive them on to the unsprayed new growth. The number of eggs, which varies with the size of the scale, ranged from 21 to 77. The presence of the male of *L. ulmi* has never been recorded in British Columbia.

BUCKELL (E. R.). *Hemisarcoptes coccisugus* **Lignières, an Enemy of the Oyster Shell Scale.**—*Proc. Ent. Soc. B.C.*, no. 28, pp. 14–15. Vancouver, B.C., 1931.

Brief notes are given on the Canestrinid, *Hemisarcoptes coccisugus*, Lign., which occurs in Europe, Canada and the eastern United States, and feeds chiefly on the eggs and young nymphs of the oyster shell scale [*Lepidosaphes ulmi*, L.]. In California it also attacks the San José scale [*Aspidiotus perniciosus*, Comst.] and probably others. This mite was introduced into British Columbia from eastern Canada in 1917, when it was liberated on apple trees and wild bushes on which it rapidly became established. It is now mainly of use in controlling *L. ulmi* on wild bushes and has materially reduced the infestation on

these in the Vernon District. Its value on apple trees is lessened by its susceptibility to the sprays applied against the scale. Little is known of its life-history, but the mite, which spreads very slowly, has been found to lay 15–20 eggs.

VENABLES (E. P.). *Aphelinus mali* **Hald., a Parasite of the Woolly Aphis.**—*Proc. Ent. Soc. B.C.*, no. 28, pp. 16–18. Vancouver, B.C., 1931.

The successful introduction of *Aphelinus mali*, Hald., into many parts of the world against *Eriosoma lanigerum*, Hausm., is briefly reviewed, a short account being given of its importation into the Okanagan Valley, British Columbia, in 1929 from Ontario and of the possibilities of its final establishment there. The severity of the winter, combined with the attacks of Syrphid larvae, is likely to reduce the numbers of the Aphid overwintering on apple to such an extent as to render the supply of *E. lanigerum* insufficient for the oviposition of its parasite.

LEECH (H.). *Drosophila funebris* **as a Host of the Fungus** *Stigmatomyces.*—*Proc. Ent. Soc. B.C.*, no. 28, pp. 19–20. Vancouver, B.C., 1931.

Drosophila funebris, F., breeding in rotten potatoes and carrots in the basement of a building, was found to be infested by a fungus, *Stigmatomyces* sp., whereas another species of Drosophilid, breeding under the same conditions, was entirely free from it. It has been stated that the Laboulbeniaceae are not in any way detrimental to their hosts and are exceedingly specific in their attachment, but in the cases observed the fungus seemed capable of growing on any part of the flies except the wings and eyes.

DOWNES (W.). **Holly Insects.**—*Proc. Ent. Soc. B.C.*, no. 28, pp. 25–28. Vancouver, B.C., 1931.

When young hollies were first imported into southern British Columbia, the coastal region of which has proved to be very favourable to their growth, *Phytomyza ilicis*, Curt., was introduced with them, and it is now rare to find an uninfested holly bush in any part of southern Vancouver Island. The disfigurement of the leaves caused by this Phytomyzid is serious, the percentage of affected leaves being often as high as 75–80. The adults appear about 5th May and continue to emerge throughout the month, the maximum occurring about the 12th. From one to five eggs are deposited within a few days of emergence in the midrib of the young leaf on the lower surface. The number of larvae found on a leaf, however, averages two and rarely exceeds three. The first traces of mines are seen in the leaves in August, but injury does not become noticeable until January, when the larvae continue feeding in mild weather, and in February the mine assumes the appearance of a blotch. Pupation begins in February and in most years is complete by the end of March. The number of adults decreases rapidly during the last week in May, and they have usually disappeared entirely by the third week in June. Efforts to destroy the larvae within the leaves have proved ineffectual owing to the difficulty of reaching them. The best results hitherto obtained have been from dusting with nicotine

and lime to destroy the adults. In experiments with a 2 per cent. nicotine-lime dust applied with a rotary duster, it was found that few flies escape, and that they begin to fall within 30 seconds. As many as 3,000 dead flies were collected from beneath a heavily infested tree 10 ft. high. The dust should be applied as soon as the flies appear, and satisfactory control should be obtained with 3 or more applications made at weekly intervals. The cost of the dust is from $\frac{3}{4}d.$ to $1\frac{1}{4}d.$ a tree.

Rhopobota naevana ilicifoliana, Kearfott (holly bud moth), all stages of which are described, is another imported pest of holly that is now generally distributed throughout British Columbia, although it does not cause serious damage. The injury involved in checking the young growth and causing branching is, however, sufficient to necessitate regular control measures in commercial plantings. The winter is spent in the egg stage, and the young larvae appear in the buds towards the end of April or early in May, as soon as the young leaves begin to form, as many as three having been found in one shoot. They live at first between the terminal leaves of the young shoots without spinning a web. By the third week in May most of them have begun to join the terminal leaves together, gradually forming a compact case by joining them at the tips. From this stage onward not more than one larva is found in a shoot, but practically every shoot is attacked. In the final stage the larvae eat back the shoot, so that the leaves spun together die and are eventually pushed off by subsequent new growth. Most of them leave the nests when full grown and spin a loose cocoon between dead leaves or rubbish on the ground, very few pupae being found on the trees. Pupation begins about the first week in July. The eggs are laid singly on the lower surface of mature holly leaves, a few being deposited in the branches. In attempts to control this moth the best results have been secured with a spray consisting of 1 oz. nicotine sulphate, 4 oz. fish-oil soap, 3 oz. lead arsenate and 3 gals. water applied before the young larvae have begun to spin the terminal leaves together. As the hatching period may extend for 2 weeks, a second application should be made a week after the first. Dead leaves should be gathered up and burned early in July, just before the moths emerge.

GLENDENNING (R.). **The Progress of Parasite Introduction in British Columbia.**—*Proc. Ent. Soc. B.C.*, no. 28, pp. 29–32, 1 ref. Vancouver, B.C., 1931.

The first parasite to be introduced into British Columbia was the mite, *Hemisarcoptes coccisugus*, Lign., which was liberated in 1917 and, without spreading greatly, has effected excellent control of the oyster shell scale [*Lepidosaphes ulmi*, L.] under certain conditions. *Aphelinus mali*, Hald., was liberated in 1922 against the woolly aphis [*Eriosoma lanigerum*, Hausm.] and although surviving, has not completely controlled its host. *Calosoma sycophanta*, L., consignments of which were sent from New England to Saanich against the tent caterpillar [*Malacosoma* sp.] in 1917 and 1918, has not been seen for many years.

The first shipments of parasites direct from England were made in 1928, when *Digonochaeta setipennis*, Fall., was introduced against the European earwig [*Forficula auricularia*, L.], and *Blastothrix sericea*, Dalm., against *Lecanium* (*Eulecanium*) *coryli*, L., which has caused much damage in and around Vancouver since its accidental introduc-

tion in 1903. Although repeated liberations have been made each year no recoveries of *D. setipennis* have yet been secured, but *B. sericea* was found to be freely established in 1929, and the parasite colony now covers an area 7 miles long and 3 miles wide, the proportion of parasitism being 11–53 per cent. The greatest distance that *B. sericea* was found to have spread from the liberation point within the limits of three generations was two miles.

Compsilura concinnata, Mg., has been recently introduced from the United States against the satin moth [*Stilpnotia salicis*, L.], but this Tachinid hibernates as an immature larva within its host and is said to be unable to do so in the young larvae of *S. salicis*, the necessary alternative hosts for it not yet having been found.

BEALL (G.). **Notes on the Termites of British Columbia.**—*Proc. Ent. Soc. B.C.*, no. 28, pp. 33–35. Vancouver, B.C., 1931.

Termopsis angusticollis, Hagen, and *T. nevadensis*, Hagen, are the termites most commonly observed on the mainland of British Columbia, which is the only Province in Canada where these insects occur, *Reticulitermes hesperus*, Banks, which is uncommon, being also present. Notes are given on the distribution and habits of all three species. In the latitude of Vancouver and Victoria, *T. angusticollis* usually swarms about the first week in September, and *T. nevadensis* about two weeks later. *R. hesperus* has been taken swarming about the middle of August in two successive seasons, the flights being apparently of short duration. Both species of *Termopsis* are found in old stumps and logs, especially if the latter are partly buried. *R. hesperus* generally inhabits dry, half-buried wood, lying on warm slopes. Both species of *Termopsis* were found to be tolerant to water and frost, factors generally considered to be markedly inimical to termites.

BLUNT (D. L.) and others. **Report on the 1931 Locust Invasion of Kenya (January 1st to August 31st).**—*Bull. Dept. Agric. Kenya*, no. 21 of 1931, 45 pp. Nairobi, 1931.

The invasion of Kenya by *Schistocerca gregaria*, Forsk., which began in 1928 and reached its maximum in 1929 [*R.A.E.*, A, xviii, 83], had ceased to be serious by the beginning of 1930. Breeding, however, continued in parts of the Northern Frontier province during 1930 and 1931, and is still in progress on the Juba River and in Abyssinia, though no swarms were observed in settled areas of the Colony in 1931.

In January 1931, swarms of *Locusta migratoria migratorioides*, Rch. & Frm., made their appearance in the western part of the Colony, and by March, when egg-laying and hatching were observed, most of the areas west of and within the Rift Valley had been invaded. The infested area, which had been estimated to be 5,000,000 acres, proved to be considerably greater.

The principal control measure was the use of poisoned baits prepared according to the following formulae: coffee parchment (a waste product from coffee cleaning mills) 16 bags (of 50 lb.), cow-dung 4 bags, sodium arsenite 44–50 lb. dissolved in 24–32 gals. water, molasses 12 pts.; or coffee parchment 100 lb., old maize flour or crushed wheat 20 lb., rice husks 5 lb., water 8 gals. containing 66 oz. sodium arsenite, molasses $2\frac{1}{2}$ pints. Amyl acetate as an attractant, in the proportion of $1\frac{1}{4}$ oz. per 100 lb. of bait, proved very effective, but it is volatile and

quickly loses its potency. Over 7½ million pounds of this bait were issued during the campaign, but even this quantity was not equal to requirements. The optimum rate of application has been found to vary from 30 lb. per acre in dry areas to 100 lb. where succulent foods are present. The total cost, inclusive of all materials, wages, transport, etc., was about a shilling per bag of 50 lb. A solution of 6–7 oz. sodium arsenite in 4 gals. water is effective as a contact spray against hoppers of all stages and adults. A trap pit of the "V" type is particularly effective against hoppers of *L. migratoria migratorioides* because of the habit of this species of moving in a formation having a narrow front and great depth, often along a road or path. Flame throwers were found extremely expensive to operate.

For protecting crops against flying locusts, smudge fires are more effective than noise or movement, though the beating of tins, use of whistles and waving of flags, particularly black ones, sometimes produced good results. For smudge fires long, low heaps of fairly dry brushwood covered with a thick layer of wet weeds and well pressed down should be prepared beforehand. Variations in wind often greatly affect the results. A method of producing smoke screens by injecting crude oil and coal tar in equal proportions into the hot manifold of a tractor is described.

The campaign, the cost of which is estimated to have been nearly £65,000, resulted in the extermination of about 80 per cent. of hoppers hatched within the Colony.

About 60 per cent. of the crops, to the total value of not less than £250,000, were destroyed by locusts, mainly by swarms hatched outside the Colony, the most seriously affected being maize, wheat, barley, sugar-cane, *Eleusine indica*, *Sorghum* and grass and at a later stage, *Cajanus indicus*, bananas, *Dolichos lablab*, beans and buckwheat.

In the first of four appendices, H. Wilkinson (pp. 21–35) describes observations on the bionomics of *Locusta migratoria migratorioides* made during the campaign. Egg-laying was concentrated in the area bordering lake Victoria, mainly in short grass and also in sugar-cane lands, at altitudes ranging from 3,800 ft. to over 9,000 ft., the oviposition period lasting 3–6 weeks. It is believed that a female may lay 4–6 egg-pods, which contain 18–72 eggs each. The incubation period varied from 15 to 48 days; at altitudes between 3,875 and 4,250 ft., every rise of 150 ft. extended it by three days; between 5,375 and 6,375 ft., altitude had no apparent effect; and from 7,000 to 8,375 ft., a rise of 250 ft. extended it by four days. The development of hoppers occupied 39–64 days. The adults did not become sexually mature for at least three months, even in regions around lake Victoria where the humidity is normally high. During this period, great damage was done to crops by circling swarms, which at that stage, although preferring graminaceous food, attacked many other plants.

Threadworms (*Mermis* sp.) were found in hoppers of all stages as well as in adults. In the latter, the percentage of infestation varied from 3 to 72, and in one case thousands of locusts were found dead on coffee bushes, the ground beneath being covered with worms. Up to 53 per cent. of egg-pods in one laying ground were infested by larvae of a Tachinid.

An account of a fungus, *Empusa grylli*, in adult locusts is given in Appendix ii by C. A. Thorold (pp. 36–38). It was observed in districts where low night temperatures did not occur and where rain had fallen

regularly for some time. Experiments on the artificial infection of locusts and on culturing the fungus on artificial media were unsuccessful.

In Appendix iii (pp. 39–43), F. B. Notley reports on tests of various control methods, and the use of iron barriers and of sodium arsenite, either as a bait or a spray, is strongly advocated.

In Appendix iv (pp. 44–45), D. C. Edwards gives an account of observations on the infestation of various grasses by *L. migratoria migratorioides*. *Pennisetum* sp. was the one most often attacked, *Melinis multiflora*, *Cymbopogon afronardus*, *Brachiaria brisantha* and *Sorghum rigidifolium* being largely avoided.

UVAROV [B. P.]. **On the Locust Problem.**—*East Africa*, viii, no. 380, pp. 428–429. London, 31st December 1931.

This article consists of extracts from a memorandum prepared by the Imperial Institute of Entomology for the use of the Executive Council of the Joint East African Board.

A brief outline of the present locust situation in East Africa is given. Practically all the provinces of Uganda and Kenya and most of Tanganyika Territory are infested with eggs or flying swarms of *Locusta migratoria migratorioides*, Rch. & Frm. Swarms were present in large numbers in Nigeria during October 1931, and the next generation is expected to migrate eastwards, whereas the swarms bred in the Sudan should move southwards into East Africa. The Belgian Congo is also overrun by this locust, and *Nomadacris septemfasciata*, Serv., occurs there in numbers [*R.A.E.*, A, xix, 683].

The organisation of an effective campaign for the destruction of locusts throughout East Africa is beyond practical possibility, owing to the extent of the invaded areas, some of which are extremely difficult of access. Therefore, the policy of concentrating all efforts on the protection of crops by destroying the locusts in and near cultivated areas is advocated. Of the control measures discussed, the use of poison baits is particularly recommended.

The present outbreak is regarded as likely to continue for at least one or two years and possibly much longer, and a repetition of it should be expected after an interval of 10–15 years. It is, therefore, essential for the prevention of future outbreaks to discover the permanent breeding grounds of the locusts and to control them before the swarms begin to spread. The work of the Imperial Institute of Entomology in this direction is briefly described, and the necessity of ensuring its continuation over a period of years is stressed.

Le ver rose du coton, *Gelechia* (*Platyedra*) *gossypiella* **Saunders.**—*Bull. agric. Congo belge*, xxii, no. 2, pp. 168–169, 1 pl., 1 ref. Brussels, June 1931.

Since the introduction of *Platyedra* (*Gelechia*) *gossypiella*, Saund., into the Belgian Congo, where it was observed in 1927 [*R.A.E.*, A, xvi, 303], it has become more widely distributed and is now present in several of the northern districts. A short account is given of the injury it causes, and the adult and larva are compared with those of *Pyroderces simplex*, Wlsm., and *Diparopsis castanea*, Hmps., with which it might be confused.

Bredo (H. J.). **Destruction des sauterelles. La méthode du rabattage.** —*Bull. agric. Congo belge*, xxii, no. 2, pp. 279–289, 3 figs. Brussels, June 1931.

The invasion of north-eastern Katanga, in the Belgian Congo, by *Nomadacris septemfasciata*, Serv., in 1930 [*R.A.E.*, A, xix, 683] is discussed. Eggs were laid by the invading swarms towards the end of December in grassy plains, which at that period were covered with young grass. Hatching commenced about a month later, and the hoppers invaded the adjoining plantations, particularly attacking maize, *Sorghum* and ground-nuts [*Arachis hypogaea*]. Hoppers were active only during the relatively hot hours, between 8 and 11 a.m. and 3 and 5 p.m., when they migrated in dense bands, mainly along roads and paths. The adult swarms, which appeared about the end of March, made flights of 6–12 miles, often passing suitable vegetation without alighting.

Trenching is recommended as a method of control very suitable to the local conditions.

Meessen (M. T.). **L'invasion, les pontes et la destruction des acridiens en Ituri.**—*Agric. Elevage Congo belge*, v, no.17, pp. 199–200, 2 figs., 3 refs. Brussels, October 1931.

Large swarms of *Locusta migratoria migratorioides*, Rch. & Frm., invaded the Ituri province, Belgian Congo, for the first time in January and February 1931 and were present until the commencement of the rainy season in early March. In April sexually mature swarms were observed and egg-laying was general, the main breeding centres including the plains of the Semliki and lake Albert. Oviposition took place in various soils, up to an altitude of about 7,000 ft.

Régnier (P. R.). **Les invasions d'acridiens au Maroc de 1927 à 1931.**—[*Morocco*]: *Dir. gén. Agric. Comm. Colonis.*, Défense des Cultures, no. 3, v+139 pp., 9 maps. Rabat, 1931.

Morocco remained free from invasion by *Schistocerca gregaria*, Forsk., between 1919 and 1927. In the latter year, however, the first swarms appeared in the Drâa valley, south of the Anti-Atlas range. Some of these crossed into the Souss valley and penetrated to the north of the Grand Atlas, but on the whole, the invasion was of little importance. During the winter of 1928–29 the infestation was more extensive, while in 1929–30 the invading swarms reached the Mediterranean coast, some of them crossing the Straits of Gibraltar into Spain. The area infested by eggs was estimated to be about 2,000,000 acres, and about 1,235,000 acres of crops, to the value of 100 million francs, were destroyed. In every case the adults of the summer generation bred in Morocco formed swarms that migrated southwards into the desert across the Atlas ranges. Only a few swarms were observed in 1931. The movements of swarms are recorded in detail and illustrated by a series of maps; the records of swarms of this locust and of *Locusta migratoria migratorioides*, Rch. & Frm., observed in 1927–31 in Mauritania and French Sudan are also included.

From an analysis of the data it is concluded that there exist in the vicinity of the Drâa valley temporary or possibly permanent breeding areas of *S. gregaria*.

The organisation of control operations is described in great detail, their cost being over a million francs in 1928–29, about 44 millions in 1929–30, and about two millions in 1930–31, and the number of working days involved in 1929–30 was about a million.

It is considered that the collection and mechanical destruction of the adults did not produce results commensurate with the labour expended. Flame-throwers of various types were tried, but proved unsuitable except when dealing with exceptionally dense, stationary swarms. The cost of this method is very high, as is that of collecting the egg-pods. Results with the latter were never satisfactory. It is preferable, therefore, to mark carefully all egg-deposits, so that operations against the hoppers may be conducted in the most effective way.

The use of cresyl as a contact spray against hoppers was found to be impracticable on a large scale, as well as very expensive. Zinc barriers, a great number of which were used, had serious disadvantages. They should only be employed against large columns of hoppers in open country where there are no valuable crops.

The standard method adopted was the use of poisoned baits consisting of 1·5–2 lb. sodium arsenite (containing 80 per cent. of As_2O_3), 100 lb. bran and 8 lb. molasses. Experiments with baits prepared with sodium fluosilicate showed that it is less effective than sodium arsenite if used at the same rate, but if the dosage is increased by about one-third, the toxicity is practically the same while the cost is lower. The mortality produced by derris powder did not exceed 50 per cent., and that produced by rotenone was only 10 per cent. Of a number of attractants studied, only amyl acetate, amyl valerianate and allyl isosulfocyanate proved of any value. Rice bran was found to be a very good substitute for wheat bran.

Field experiments with hydrocyanic acid, produced by calcium cyanide dust, showed that a sufficient mortality of hoppers can only be obtained at very high concentrations, which makes this method expensive and dangerous. Cage experiments with the same gas, chloropicrin, and ammonia proved that locusts are very resistant to them.

A series of biological observations were made during the campaigns ; most of these have been dealt with elsewhere [*R.A.E.*, A, xix, 55, 231, 599].

The following fungi were observed attacking both hoppers and adults : *Empusa grylli* (in cages only), *Fusarium* sp., *Spicaria verticilloides*, *Beauveria bassiana*, *B. densa* and *B. globulifera*. Predators included birds, beetles, *Tettigonia viridissima*, L., *Sphodromantis viridis*, Forsk. (*bioculata*, Burm.), and an Asilid fly, *Machilis* sp. The eggs were destroyed by the larvae of the following Diptera : *Stomatorrhina lunata*, F., *Phorbia* (*Chortophila*) *cilicrura*, Rond., and *P.* (*C.*) *pilipes*, Stein, and, probably, the Bombyliid, *Lomatia hamifera*, Becker. *Sarcophaga haemorrhoidalis*, Fall., was bred from the adults, and *Muscina stabulans*, Fall., and *Fannia canicularis*, L., have also been bred from locusts [the last two species being probably only saprophytic.—Ed.]. The Conopid, *Myopa picta*, Panz., is thought to be a parasite of the adults.

Dociostaurus maroccanus, Thunb., appeared in Morocco in 1928, and some swarms were also observed in 1929, but none in 1930. The movements of swarms, position of egg-deposits and organisation of the

campaigns are briefly discussed. From 1929, control was carried out exclusively by poisoned baits, with excellent results. The parasites of this locust include the Bombyliid flies, *Anastoechus nitidulus*, F., and *Cytherea* (*Glossista*) *infuscata*, Mg., and a Clerid beetle, *Trichodes* sp.

FEYTAUD (J.). **Comment progresse l'invasion doryphorique.**—*Rev. Zool. agric.*, xxx, no. 5, pp. 69–82, 2 refs. Bordeaux, May 1931. [Recd. December 1931.]

The situation with regard to the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] in France is compared in the successive years since its original discovery in 1922, showing that the infested area has increased each year and that the increase was most rapid in 1929 and 1930. The average rate of spread has not exceeded 10 square miles a year and this, compared with the rapid extension of infestation in the United States, shows the value of the control measures that have been employed. The methods of dissemination of the beetle are explained in detail. During the larval stage there is little movement, although the larvae are capable of travelling for several yards. The adults, however, may crawl for 100 yards or more, fly considerable distances, or be carried far on streams. Flight, of which a more detailed account is given in a paper noticed elsewhere [*R.A.E.*, A, xx, 4] is determined by high temperatures and occurs in the sunniest period of the day. It has been observed that the autumn generation is particularly liable to take wing, the greatest distances being traversed late in the season. Although this beetle does not feed on the potato tubers, it is quite possible that, owing to its habit of spending a great part of the year in the soil, it may be dug up and transported with them. Vehicles or animals passing through heavily infested fields may also serve to carry the pest to other parts, and any individuals collected should be immediately destroyed. The legislation regarding the transport of potatoes is quoted.

DELASSUS (M.) & LEPIGRE (A.). **Les efforts faits par les manufacturiers algériens pour assurer la protection des tabacs d'exportation.**—*Afr. N. illus.*, Suppl. *Afr. N. agric.*, no. 544, pp. 3–5; no. 546, pp. 3–5. Algiers, 3rd & 17th October 1931.

Owing to the heavy and continued depredations of *Lasioderma serricorne*, F., in tobacco exported from Algeria [*R.A.E.*, A, xviii, 364], the Algerian Government has instituted research to devise a practical method of controlling it. An account is given of this beetle as occurring in stored tobacco [vii, 366]. The eggs, which are deposited between the leaves of dried tobacco or in their folds, are so small as to be practically invisible, and since development is rapid under the conditions of high temperature and humidity existing in the holds of ships, consignments that appear to be free from infestation when leaving Algeria may be considerably damaged before arrival at their destination. Development is most rapid at temperatures between 28° C. [82·4° F.] and 32° C. [89·6° F.]. At 47° C. [116·6° F.], activity ceases, and the insect dies at temperatures above 60° C. [140° F.]. Cold does not readily kill the beetles, which can live for some hours even at — 18° C. [0·4° F.]. The greatest damage is done to

the leaves used for wrapping cigars, which become pierced with holes. In cigarettes, much of the tobacco is reduced to a fine powder. The loss may amount to 5 per cent. by weight after one year's storage and to more than 10 per cent. after 2 or 3 years. The damage is generally greater on the poor tobacco grown on mountains than on the heavier kinds, rich in nicotine, with more sticky leaves, from the alluvial plains. Chopping the leaves, following the intense compression to which they are subjected, destroys all stages except, perhaps, a few eggs, and roasting at temperatures between 60° C. [140° F.] and 85° C. [185° F.] disposes of these. Further damage therefore comes from re-infestation of the tobacco while awaiting further operations.

The beetles hide and deposit their eggs in cracks in old woodwork, especially where there is dust, such as are common in old factories. These may be treated with jets of hot steam, boiling water, kerosene, or carbon bisulphide, though these are only temporary remedies. A better plan is to replace all woodwork in storerooms by plaster, cement or metal, filling in the joins with putty; and on the floor of cement or concrete, where direct contact would produce mould, new wooden planks, which can later be used for the construction of boxes, should be laid under the stacks of tobacco. All windows should be screened with wire gauze of 1 mm. mesh, and doors should close automatically. On the floor under the door, on the edge of it and on the face of the wooden casing opposite to it, a shallow trench should be made and filled with some sticky substance, viscous enough not to run. Any beetles that succeed in passing these barriers should be caught, before they have time to deposit their eggs, by means of light traps, of which various kinds are described, all consisting of a light within some sort of framework bearing paper or glass smeared with a sticky substance. In some store rooms the windows are merely covered with transparent paper smeared with an easily renewed glue. The bales of tobacco should be spaced apart from one another, and the successive layers should be separated by wooden joists. It is hoped that these measures will be sufficient to protect the tobacco up to the time of packing, without recourse to fumigation, which is much more expensive and complicated.

Koch (H.). **Vergleich zwischen drei verschiedenen Methoden des Probesammelns.** [A Comparison between three different Methods of Sample Collections.]—*Forstl. Wschr. Silva*, xix, no. 33, pp. 259–261, 2 figs. Berlin, 14th August 1931.

Three methods of sample collection used in pine stands for determining the abundance of the pine moth [*Panolis flammea*, Schiff.] and other forest pests are discussed and compared, diagrams being given illustrating their nature.

Riehm (E.). **Pflanzenschutz-Praktikum.** [A practical Handbook on Plant Protection.]—Cr. 8vo, viii+100 pp., 45 figs. Berlin, Paul Parey, 1931. Price *M.* 4·50.

This booklet is intended primarily for students of agriculture and forestry, but is of interest to all concerned with plant protection work against insect, fungous or vertebrate pests. Chemical, biological and

mechanical control measures are surveyed, with details and illustrations of the necessary apparatus for testing and applying the materials used.

MARTINI (E.). **Zur Gradationslehre.** [Contribution to the Theory of the Rate of Increase.]—*Verh. deuts. Ges. angew. Ent., 8. Mitgliederversamml. Rostock Aug. 1930*, pp. 19–26. Berlin, 1931.

This is a general discussion of the factors affecting the distribution and increase of insects. The author agrees with Thompson as to the importance of biological control in the re-establishment of the equilibrium [*R.A.E.*, A, xvi, 484; xviii, 80], but dissents from his view that general limiting factors, such as climate, act in proportion to the numbers of the organism they affect, whereas individual limiting factors, such as parasites, destroy an absolute number, because, for example, an individual parasite can only lay a certain number of eggs irrespective of whether the host is abundant or scarce. This may sometimes be so, but other examples show that these individual factors may increase even more than proportionally. A truly regulating factor would be not a proportionally increasing one, but one that would grow more than proportionally during a climax (increase in the reproductive rate) and again fall more than proportionally during the decrease in the numbers of an organism (anticlimax of the reproductive rate). When, for example, of two factors that maintain the rate of increase at 1, one is so weakened that the rate gradually rises to 2, the increase of the organism in question would continue indefinitely, even if the " general " limiting factor were to destroy twice the quantity that it used to destroy of the now doubled number of the organism. Only when a limiting factor destroys of a doubled quantity considerably more than twice as much as it originally did, or of a quadrupled quantity much more than four times, will it be able to reduce the numbers of the organism, the increase of which has been due to the change that has taken place in the second factor.

STELLWAAG (F.). **Grundlagen der physiologischen Wertbestimmung von Insektiziden.** [The Principles of the physiological Valuation of Insecticides.]—*Verh. deuts. Ges. angew. Ent., 8. Mitgliederversamml. Rostock Aug. 1930*, pp. 29–31. Berlin, 1931. (Not published, abstract in *Anz. Schädlingsk.*, vi, no. 10, pp. 113–114. Berlin, 15th October 1930.)

The author reviews his work on the physiological determination of insecticidal values by laboratory experiments [*R.A.E.*, A, xvii, 685; xviii, 433, 525] and emphasises the fact that it is not the poison itself or the amount of it in an insecticide that is of importance, but rather the form of combination and the digestibility of the substance, qualities that cannot be determined by chemical analysis alone. If stress were laid on the form of combination of poisons, it would result in the introduction of insecticides that would be lethal to insects in very small doses and less dangerous to mammals than the chemical preparations now in use. The physiological valuation of poisonous substances is possible only when the work is carried out with minimum lethal doses; the determination of the latter permits of a definite comparison and forms the basis of all discussions of the applicability of a preparation.

Friederichs (K.). **Einleitendes Referat zum Tagesthema "Der Kiefernspanner."** [An introductory Paper on the Pine Moth.]— *Verh. deuts. Ges. angew. Ent., 8. Mitgliederversamml. Rostock Aug. 1930*, pp. 31–36. Berlin, 1931.

General information is given on the bionomics of the pine moth [*Bupalus piniarius*, L.] in Germany, based on personal observations and data from the literature. The factors tending to cause outbreaks are discussed; these usually occur in dry areas with an average yearly precipitation of 20–24 ins. and an average temperature of 7–8° C. [44·6–46·4° F.]. As a control measure, clearing the ground litter in infested forests to destroy the pupae is recommended. The use of pigs may also be of value at the beginning of an infestation in areas where outbreaks develop slowly.

Eidmann (H.). **Erfahrungen über die Arsenbekämpfung von Forstschädlingen mittels Motorverstäuber.** [Experiments in the Control of Forest Pests with Arsenicals by Means of Motor Dusters.]— *Verh. deuts. Ges. angew. Ent., 8. Mitglicderversamml. Rostock Aug. 1930*, pp. 37–38. Berlin, 1931. (Not published, abstract in *Anz. Schädlingsk.*, vi, no. 10, pp. 114–115. Berlin, 15th October 1930.)

An account is given of experiments against *Cheimatobia brumata*, L., and *Tortrix viridana*, L., in an old oak stand near Breslau (Silesia) with a proprietary arsenical dust distributed by a motor power duster. Nearly all the larvae of *C. brumata*, which was the predominant species, were killed within 6 days after the application, whereas a considerable number of those of *T. viridana* survived owing to the protective cover of the leaves rolled by them. Excreta counts showed that feeding was greatly reduced immediately after the dusting.

It is thus possible successfully to control forest pests in small areas by dusting from the ground, though aeroplanes are necessary when large ones are involved.

May (E.). **Biologische Feststellungen bei der Arsenbekämpfung des Kiefernspanners.** [Biological Data obtained during the Control of the Pine Moth with Arsenicals.]— *Verh. deuts. Ges. angew. Ent., 8. Mitgliederversamml. Rostock Aug. 1930*, pp. 38–40. Berlin, 1931.

Failure to control the pine moth [*Bupalus piniarius*, L.] in Pomerania in 1928 was attributed to the abundant rainfall and cold that prevailed. As unsatisfactory results were also obtained in many districts in Germany in 1929 when the weather was extremely dry and hot, field and laboratory observations were carried out in the summer of that year to study the effect of environmental factors on the rate of feeding of the larvae. It was found that under dry conditions, at temperatures varying from 18 to 36° C. [64·4 to 96·8° F.] and a relative humidity of 60–95 per cent., the larvae did not feed readily, though they consumed the untreated needles more readily than the dusted ones. When, however, drops of water were placed on the needles, they readily devoured both treated and untreated ones, those that fed on the former dying on the third day. It is therefore concluded that dew and mist are essential for the successful control with arsenical dusts of the later instars of this moth, and it is economically unjustifi-

able to double the dosage if the weather is dry. The younger larvae, on the other hand, are not only very susceptible to the effect of the poison, but are unable to abstain from feeding. The dust should therefore be applied as soon as the eggs have hatched.

MEYER (R.). **Erfahrungen bei der Kiefernspannerbekämpfung.** [Experiences in the Control of the Pine Moth.]— *Verh. deuts. Ges. angew. Ent., 8. Mitgliederversamml. Rostock Aug. 1930,* pp. 40–44. Berlin, 1931.

The dependence of the effectiveness of arsenical preparations against the pine moth [*Bupalus piniarius*, L.] on the rate of feeding of the larvae, which in its turn is affected by the weather conditions, is discussed [see preceding paper], and an account is given of the excellent results obtained from the application by aeroplane of a proprietary contact dust insecticide, at the rate of about 55 lb. to the acre, to two severely infested pine forests in northern Germany in the autumns of 1928 and 1929. The larvae began to die within 2 hours, the number of individuals killed rapidly increasing on the two following days.

JANISCH (E.). **Ueber einige Grundfragen der Insektenepidemiologie.** [On some basic Questions of Insect Epidemiology.]— *Verh. deuts. Ges. angew. Ent., 8. Mitgliederversamml. Rostock Aug. 1930,* p. 45. Berlin, 1931. (Not published, abstract in *Anz. Schädlingsk.*, vi, no. 10, pp. 116–117. Berlin, 15th October 1930.)

In studying and comparing the effect of environmental factors on the development of insects, to determine the causes of outbreaks, it is important that observations and tests should be carried out with physiologically similar individuals. The rate of development is checked by unfavourable conditions of temperature, light, nutrition, humidity, etc., the influence of each of which should be evaluated. Only absolutely optimum conditions (that is, a combination of all individual optimum factors) can serve as a basis for comparative tests with various insects, as has been proved by laboratory observations of *Prodenia* [*litura*, F.] [*R.A.E.*, A, xviii, 241] and other insects. The duration of the life of an insect alone is not sufficient to determine the influence of the environmental factors; the individual life-cycle has also to be taken into consideration.

MALENOTTI (E.). **Ergebnisse in der Bekämpfung der Maulwurfsgrille in Italien.** [Results of the Control of the Mole-Cricket in Italy.]— *Verh. deuts. Ges. angew. Ent., 8. Mitgliederversamml. Rostock Aug. 1930,* pp. 45–49. Berlin, 1931.

Successful control of the mole-cricket, *Gryllotalpa gryllotalpa*, L. (*vulgaris*, Latr.), has been obtained in various districts of Italy by means of zinc phosphide bait [*R.A.E.*, A, xviii, 45, 335; xix, 184], applied at the rate of about 18 lb. to the acre. In laboratory experiments in making the bait waterproof, olive oil was substituted for the water in the proportion of 4 parts, by weight, of oil to 100 of broken rice and 5 of the poison. The insects were killed within 2 days, though the bait thus treated had been soaked in water for 5 hours prior to being used.

Malenotti (E.). **Die Bekämpfung der Kirschfliege in Italien.** [The Control of the Cherry Fly in Italy.]— *Verh. deuts. Ges. angew. Ent., 8. Mitgliederversamml. Rostock Aug. 1930,* pp. 49–54. Berlin, 1931.

As a result of legislation in England, Belgium and Germany prohibiting the importation of cherries from Italy as a precaution against the introduction of the cherry fly [*Rhagoletis cerasi*, L.], observations on its biology and experiments in its control were carried out by a number of State plant protection stations in various parts of Italy. It was found that in the north oviposition does not occur before the end of May [*cf. R.A.E.*, A, xix, 697] ; early varieties of cherry therefore escape infestation, even in years of severe outbreaks. In 1930 the numbers of the fly varied considerably in different districts, being especially high in the environs of Bolzano (Bozen) in the Italian Tyrol. Observations have shown that some of the pupae give rise to adults in the second year following that of oviposition. By keeping infested fruit in cold storage at 2–4° C. [35·8–39·2° F.], 98 per cent. of the larvae were killed in 25 days. Adult flies were successfully controlled by spraying at varying intervals from mid-May till 7th June with a mixture of 3 gals. beet molasses from which the sugar had been removed [*cf.* xviii, 368], 10 lb. lead arsenate paste and 95 gals. water, applied at the rate of about 2 pints to a tree. On the treated trees the rate of infestation was only 4 per mille as compared with 4 per cent. on the unsprayed ones. The spray, however, scorched the leaves. An attempt to poison the adults by means of maize leaves dipped in a bait consisting of 3 gals. desugared molasses, 30 lb. lead arsenate and 20 gals. water, and fixed to the branches under small zinc shelters, was unsuccessful.

Hukkinen (Y.). **Ueber das Auftreten und die Bekämpfung des Meerrettichblattkäfers** (*Phaedon cochleariae* **Fabr.) in Finnland.** [On the Occurrence and Control of the Horse-radish Leaf Beetle (*P. cochleariae*, F.) in Finland.]— *Verh. deuts. Ges. angew. Ent., 8. Mitgliederversamml. Rostock Aug. 1930,* pp. 76–84, 1 map. Berlin, 1931.

The Chrysomelid, *Phaedon cochleariae*, F., appeared in Finland for the first time in great numbers in 1908 in the south, several acres of turnips being completely destroyed. Since then it has spread in all directions, and severe damage to turnip has in many instances compelled the growers to abandon the cultivation of this crop. There appear to be two overlapping generations a year, and the life-history is similar to that in Russia [*R.A.E.*, A, ix, 350]. Hibernation takes place in the ground as well as various shelters, such as old wooden fences, thatched roofs, stacks, etc. The adults live long, and oviposition lasts from the end of May till September. Both the adults and larvae cause severe damage to a number of crucifers, of which turnip is markedly preferred ; swede and cabbage usually escape infestation, as no eggs are laid on these plants when they are more advanced in growth. The extensive cultivation of turnip in Finland may be responsible for the increase of the pest, as this plant offers favourable conditions for the development of the second generation at the end of the summer.

The larvae are partly kept in check by the Tachinid parasite, *Meigenia floralis*, Fall., and by *Microbracon* (*Bracon*) *guttiger*, Wesm., and the eggs are destroyed by predacious Coccinellids and Capsids.

Remedial measures recommended are the destruction of cruciferous weeds in cultivated fields ; the collection of adults by shaking them off the plants into a suitable receptacle ; the sowing of a trap crop of white mustard (*Sinapis alba*) in the spring, on which the overwintered beetles readily concentrate and may be collected ; and dusting with arsenicals. The " Puhuri " duster [xvi, 594] has proved to be specially suitable.

KNECHTEL (W. K.). *Thrips tabaci* **Lind. ein Feind der an der Schwertlilie vorkommenden Blattwespe** *Rhadinoceraea reitteri* **Kon.** [*T. tabaci*, an Enemy of the Sawfly, *R. reitteri*, occurring on Yellow Flags.]—*Z. Insekt Biol.*, xxvi, no. 4–6, pp. 149–151, 1 fig. Berlin, 15th September 1931.

In Rumania *Iris pseudacorus* and other species of the genus are often destroyed by large numbers of the sawfly, *Rhadinoceraea reitteri*, Konow, the female of which oviposits in the leaves. *Thrips tabaci*, Lind., which is a pest of tobacco, onion, and fruit trees, in Rumania, has been observed sucking the sawfly eggs, gaining access to them through the oviposition slits. Various other recorded instances of Thysanoptera preying on insects are given.

HANKE (K.). **Ein gefährlicher Vorratsschädling : Die Kornmotte.** [A dangerous Pest of Stored Products, the Grain Moth.]—*Die kranke Pflanze*, viii, no. 10, pp. 148–150, 1 pl. Dresden, October 1931.

In observations made in Saxony on *Tinea granella*, L., the stages of which are briefly described, the seeds of rye, wheat and maize were found to be severely attacked, while barley, oats, beet seed, etc., were only slightly infested. The adults were present from April to August, each female laying about 100 eggs. Incubation lasted about a fortnight. In autumn the larvae sheltered under a web, pupating there later. The pupal period occupied about 3 weeks. All stages are killed by temperatures below freezing point or exposure for 12–24 hours to 50–60° C. [112–140° F.]. The adults may be captured by light-traps or adhesive bands, and the larvae under damp sacks.

BÖNING (K.). **Versuche zur Bekämpfung der Larven der Gartenhaarmücke** (*Bibio hortulanus* **L.).** [Experiments in combating the Larvae of *B. hortulanus*.]—*Prakt. Bl. Pflanzenbau u. Pflanzenschutz*, ix, no. 7–8, pp. 145–160, 4 refs. Freising, 1931.

In 1930, *Bibio hortulanus*, L., occurred in abundance in barley fields in Bavaria and severely infested gherkins grown under glass. In experiments, which are described in detail, the larvae survived a 24-hour immersion in water without serious injury. They died if exposed on a hard surface to dry air for 2–3 hours, but lived for 2 days in quite dry sand. In the case of starving larvae kept in sand of various degrees of moisture, no relation was found to exist between moisture content and the numbers that died or pupated, so that they do not seem to be influenced in their activities by fluctuations in the water-content of the soil. A contact insecticide containing 1 per cent. tobacco extract and 1 per cent. soft soap watered on the soil gave good results, and would probably be completely successful at twice that strength. The larvae may be killed by a bait of leaves sprayed with a 0·1 per cent. solution of Paris green and placed in the soil.

Weber (H.). **Hemiptera II.**—*Biol. Tiere Deutschlands*, Teil 31, pp. 71–208, 112 figs. Berlin, Borntraeger, 1931. Subscription price *M.*12 ; single copies *M.*24.

This second section on the Rhynchota in this work [*R.A.E.*, A, xvii, 635] gives a general account of the morphology of the Cicadids and Aleurodids.

Koidsumi (K.). **Experimental Studies on the Influence of low Temperatures upon the Development of Fruit-flies. First Report.** [*In Japanese.*]—*Bull. Dept. Agric. Govt. Res. Inst. Taihoku, Japan*, no. 85, reprint 68 pp., 2 graphs, refs. Taihoku, August 1931. (With a Summary in English.)

These studies were undertaken to determine the possibility of the spread to temperate zones of *Dacus* (*Chaetodacus*) *cucurbitae*, Coq. (melon fly), a serious pest of cucurbits in Formosa and other tropical and subtropical regions.

The following is taken from the author's summary. Third instar larvae and one-day-old pupae were subjected to constant temperatures of 12–0° C. [53·6–32° F.]. At temperatures between 0 and 4° C. [39·2° F.] all the pupae were killed after about 7 days and the larvae after 7–10 ; between 5 and 7° C. [41 and 44·6° F.] the larvae and pupae all died in about 10–20 days ; between 8 and 9° C. [46·4 and 48·2° F.] all the pupae were killed in 20–70 days, and between 8 and 10° C. [50° F.] all the larvae died in 35–100. The resistance to cold of the larvae and pupae obtained for the experiments during the summer, when the temperature is 25–30° C. [77–86° F.] in Formosa, is less than that of those obtained during the spring and autumn (20–25° C. [68–77° F.]) and still less than that of those obtained during the winter (15–20° C. [59–68° F.]). The resistance was calculated by the percentage of adults produced and the minimum number of days required to obtain complete mortality ; it is higher in the larval stage than in the pupal one. The lowest temperature at which development is possible is 10° C. for both larvae and pupae, and at 10–12° C. [53·6° F.] development is greatly retarded, and only about 10 per cent. survive.

Hill (C. C.) & Smith (H. D.). *Heterospilus cephi* **Rohwer, a Parasite of the European Wheat Sawfly,** *Cephus pygmaeus* **(L.).**—*J. Agric. Res.*, xliii, no. 7, pp. 597–609, 8 figs., 6 refs. Washington, D.C., 1st October 1931.

A detailed account is given of the life-history of *Heterospilus cephi*, Rohw., a major parasite of *Cephus pygmaeus*, L. (European wheat sawfly), with descriptions of its stages and notes on the internal organs of the mature larva. It occurs throughout most of the wheat-growing areas in western New York and over a limited area in northern Pennsylvania. No other hosts have been discovered in the field, but in a large outdoor cage this Braconid readily attacked *Trachelus tabidus*, F. (black grain-stem sawfly), on which it completed its normal life-cycle. The fall in the percentage of infested wheat stalks during 1924–27 from 31 to 3 was accompanied by an increase in parasitism of from 21 to 39 per cent., which subsequently decreased to 9 and 1 per cent. in 1928 and 1929.

Oviposition occurs in late June and early July, 1–6 eggs being laid,

apparently indiscriminately, on the host larva within the wheat stem. The larvae feed through the epidermis of the host and destroy most of the body contents. The egg and larval feeding period occupy about 3 weeks, after which about 10 months are spent as a mature larva in a silken cocoon in the stem. In experiments, the prepupal period was found to last 8–16 days and the pupal 19–22. The adults live for 1–2 weeks, and of a number collected from various parts of New York 47 per cent. were females. An average of 3 parasites was observed to mature on a single host.

COLLINS (C. W.) & HOOD (C. E.). **Control of the Satin Moth by Spraying in alternate Years.**—*Circ. U.S. Dept. Agric.*, no. 189, 12 pp., 4 figs. Washington, D.C., October 1931.

The larvae of *Stilpnotia salicis*, L. (satin moth), which is becoming a serious pest of poplars and willows in New England, generally hibernate in crevices in the bark. They emerge in late April or May and become mature about 25th June; they pupate in loose cocoons, the adults emerging during a period of about 3 weeks in July. The eggs hatch in about 15 days, and the larvae feed on both surfaces of the leaf until the hibernation webs are spun.

The comparatively recent use of fish-oil with lead arsenate against this pest has enabled the arsenic to remain on the foliage for so much longer that experiments were undertaken with a view to controlling both generations of larvae with only one application of the spray. Details of these during three years are given, and the results clearly prove that the moth can be satisfactorily controlled for two years by one application in May or early June of a mixture of 5 lb. lead arsenate powder in 100 U.S. gals. water, to which about $1\frac{1}{4}$ U.S. pints fish-oil is added while stirring. The best quality of fish-oil should be used, or raw linseed oil may be substituted. If some of the trees are very tall and only one-half to two-thirds of the foliage can be treated by the spray equipment available, fairly good control may be obtained by spraying every year.

HEADLEE (T. J.). **Report of the Department of Entomology.**—*Rep. New Jersey Agric. Expt. Sta. 1929–30*, pp. 121–200. New Brunswick, N.J., 1931.

This report covers briefly such of the investigations carried out in New Jersey during the year ending 30th June 1930 as had not at that date reached the stage for publication in bulletins or scientific papers. Much of the information given in regard to the use of the thermal constant for timing treatments for codling moth [*Cydia pomonella*, L.] and the effect of electromagnetic waves on insects has already been noticed [*R.A.E.*, A, xvii, 62; xix, 360, 486, 528]. Data are given concerning further tests of miscible pine oil (pineole soluble) [diluted with an equal quantity of water] applied to the bark of apple trees against *C. pomonella* [*cf.* xix, 264, 270]. No injury was caused to orchard trees by the use of oil emulsion and cresylic acid, which effected a considerable reduction in green and rosy apple aphis and red mite [*Aphis pomi*, DeG., *Anuraphis roseus*, Baker, and *Paratetranychus pilosus*, C. & F.] when applied against the overwintering eggs. This combination is much cheaper than any other that gives anything approaching the same efficiency, the cost of 1 U.S. spray gallon being

about ½*d.* as compared with 1½*d.* for a similar quantity of lime-sulphur-nicotine.

A number of tests against *Zeuzera pyrina*, L., with materials used with success in the previous season [xix, 168] indicated that the larvae can be killed by treating the twigs and branches of infested apple trees with miscible pine oil in which has been dissolved naphthalene, nicotine or benzyl chloride. The work can be done safely under such temperatures as obtain in the spring before the buds begin to swell, provided that the application is not immediately followed by rapid development of the buds such as would occur in periods of extremely warm weather.

In experiments made in the spring of 1930, pyrethrum extract showed itself relatively inefficient in the control of wireworms, possibly owing to the nature of the soil [*cf.* xviii, 410]. It was found that pyrethrum rendered miscible with water by the use of an oxidised and sulphonated oil was able to penetrate the soil with less loss of toxicity and little deleterious effect on the plants, a higher mortality being obtained. In further experiments against wireworms attacking germinating maize, a hollow truncated galvanised iron cone, 12 inches in diameter at the larger end, was placed over each hill, and 1 U.S. qt. water containing carbon bisulphide in emulsion form was poured into each. The results, as shown two days later by digging up each hill and counting the larvae, indicated that 1 oz. carbon bisulphide to each hill effects a very high percentage of destruction and that more does not increase the kill. Tomatos grown on land that had been previously planted with maize and treated with this emulsion suffered no material injury from wireworms.

Driggers (B. F.). **Oriental Peach Moth Investigations.**—*Rep. New Jersey Agric. Expt. Sta. 1929–30*, pp. 148–159. New Brunswick, N.J., 1931.

These investigations during 1929–30 in New Jersey chiefly consisted in the continuation of experiments to develop a satisfactory method of artificial control for the oriental peach moth [*Cydia molesta*, Busck] [*cf. R.A.E.*, A, xvii, 447, 669, 670; xviii, 406; xix, 363, 475]. Tests of samples of talc from different sources showed a variation in the percentage of larvae killed. Those samples having the greater proportion of fibre-like particles were of a softer texture, adhered better to the foliage, and gave a higher mortality. The most successful sample was selected for further tests, using different proportions of 300-mesh sulphur and 200-mesh talc. It was found that there was about a 50 per cent. increase in kill compared with sulphur alone when 1 part of talc was mixed with 3 of sulphur, and larger proportions of talc to sulphur resulted in increased kills. Against overwintering larvae on peach, spraying the trunks and branches with pineole soluble in water, 1 : 1, was not effective, probably owing to poor penetration of the bark. No injury to the trees had become apparent on 15th July 1930 from sprays applied on 24th March, but one-half of the fruit and vegetative buds that had been thoroughly soaked with the spray were killed. Unseasonably warm weather in the late winter and early spring had, however, caused some swelling of the buds at the time the sprays were applied.

Notes on the life-history and habits of the larval parasites of *C. molesta* collected for several seasons show that in New Brunswick *Macrocentrus ancylivora*, Rohw., passes the winter in the larval stage

within the mature host larva. Those larvae of *M. ancylivora* and *M. delicatus*, Cress., that emerge from the host larvae and spin cocoons in the late autumn fail to emerge the following spring. *Glypta rufiscutellaris*, Cress., emerges from the host larva in the autumn and passes the winter as a mature larva in a cocoon within that of the host, pupation and emergence occurring in the following spring. *Syntomosphyrum esurus*, Riley, was discovered parasitising pupae of *C. molesta* at New Brunswick. This Eulophid, which is reported in the literature to have been reared from pupae of *Alabama* (*Aletia*) *argillacea*, Hb., *Hemerocampa leucostigma*, S. & A., and *Hyphantria cunea*, Drury, has been reared in the insectary on pupae of *C. molesta* for several generations. The life-cycle from egg to adult at midsummer requires about 18 days. From 5 to 45 adults have been reared from one pupa. This parasite was carried over the winter in pupae of *C. molesta* that had been exposed to it in August and September 1929. The adults emerged during the first week in May.

Ginsburg (J. M.). **Oil-Pyrethrum Sprays containing Copper Oleate and their Effect on Apple Trees.**—*Rep. New Jersey Agric. Expt. Sta. 1929–30*, pp. 160–163. New Brunswick, N.J., 1931.

In continuation of studies of the effect of summer oil sprays on apple trees [*cf. R.A.E.*, A, xix, 170, 359], tests were conducted with two highly refined lubricating oils (Nujol and Primol of viscosities of 220 and 320, Saybolt/100, respectively) and sperm oil containing lead arsenate or pyrethrum extract, which latter was sometimes combined with copper oleate. After the third application, sprayed foliage began to assume a darker shade than the unsprayed, this being more noticeable in trees receiving petroleum oil than in those sprayed with sperm oil. Sprayed leaves were somewhat deficient in pubescence on the under surface and rather brittle to the touch. The spray mixture of lead arsenate containing either sperm oil or Nujol exhibited very good adhesion to the foliage. Close observations after additional tests with oil-copper oleate sprays did not reveal any injury to foliage or fruit that could be ascribed to the effect of the copper oleate in the oil. Four sprays, delayed dormant, pre-pink, pink and calyx, were applied in the early part of the growing season. The copper oleate used in these experiments contained 9 per cent. actual copper, and the concentrations varied from 1 to 14 per cent. In the delayed dormant sprays 3 per cent. of a light lubricating oil and 0·5 per cent. cresylic acid were used but in the others only 0·5 per cent. Nujol. The copper oleate was dissolved in the oil before emulsification.

Ginsburg (J. M.). **The Use of certain highly penetrating Pine Oil Derivatives as Adjuncts in Contact Insecticides.**—*Rep. New Jersey Agric. Expt. Sta. 1929–30*, pp. 167–168, 3 refs. New Brunswick, N.J., 1931.

It has been shown by several workers that the penetration of liquid contact insecticides, on which their toxicity largely depends, can be materially improved either by decreasing their interfacial tension or by incorporating in them certain chemicals possessing high wetting power on the chitinous layer in the spiracles and an appreciable rate of volatility [*R.A.E.*, A, xviii, 278, 399, 486]. Preliminary tests with honey-bees and Aphids indicate that when pine oil distillates having a

boiling range of from 170 to 270° C., and similar distillates, are mixed in either nicotine or pyrethrum sprays in a concentration of 0·25 per cent. or higher, the toxicity of the contact insecticide is increased to an extent similar to that obtained with 0·5 per cent. of soap. The pine oil distillate can be made water-miscible either by dissolving in it about 20–25 per cent. triethanolamine oleate, or by introducing the two ingredients present in this soap separately. This can best be effected by adding about 12–15 per cent. oleic acid (by volume) to the pine oil and mixing in 8–9 per cent. triethanolamine after shaking. Unless the resultant mixture is clear and transparent it will not be entirely miscible, but a turbid solution can be clarified by the addition of a few drops of oleic acid. Other emulsifiers, such as sodium oleate and sulphonated oils, were also used to make pine oil distillates miscible.

BURDETTE (R. C.). **Vegetable Insect Investigations.**—*Rep. New Jersey Agric. Expt. Sta. 1929–30*, pp. 169–170. New Brunswick, N.J., 1931.

Considerable damage was caused to the late bean crop in New Jersey in 1929 by the Mexican bean beetle [*Epilachna corrupta*, Muls.], though the number of beetles emerging in the spring of 1930 was considerably less than in 1929. Tests with a number of materials [*cf. R.A.E.*, A, xix, 271] indicated that magnesium arsenate, which was used without injury to commercial plantings both as a spray at the rate of 1 lb. to 50 U.S. gals. water and a dust at the rate of 1 lb. to 4 lb. hydrated lime, is the only substance that can at present be used with safety on beans for the control of the beetle.

The pepper maggot [*Spilographa electa*, Say], which is a serious pest of pepper [*Capsicum*] [*cf.* xviii, 410], was found for the first time in New Jersey breeding on *Solanum carolinense*, its original food-plant.

HAMILTON (C. C.). **Tests on the Control of several Insects attacking Evergreens.**—*Rep. New Jersey Agric. Expt. Sta. 1929–30*, pp. 182–186, 1 ref. New Brunswick, N.J., 1931.

Most of this information on the control of *Rhyacionia buoliana*, Schiff., and *Dichomeris marginella*, F., is contained in a paper already noticed [*R.A.E.*, A, xix, 349]. An outbreak of the Tortricid, *Taniva albolineana*, Kearfott (pine needle miner) on Colorado blue spruce [*Picea pungens*] was satisfactorily controlled by the application on 6th May of a spray containing 0·75 per cent. penetrol and a kerosene extract of pyrethrum equivalent to 0·4 per cent. pyrethrum flowers, and by a spray of pyrethrol, 1 : 100. The trees sprayed with penetrol showed slight scorching of the tips of some needles. Examination of material collected on 9th May showed 78 dead larvae, 3 live larvae, and 157 pupae from trees treated with penetrol and 53 dead larvae, 9 live larvae and 98 pupae from those treated with pyrethrol, many of the pupae in both lots being dead. Examination on 29th May showed a few living pupae and some moths in flight.

HAMILTON (C. C.). **The Penetration of Arsenate of Lead into Sod.**—*Rep. New Jersey Agric. Expt. Sta. 1929–30*, pp. 186–192. New Brunswick, N.J., 1931.

Experiments were carried out in 1929–30 to determine the extent to which various proprietary brands of lead arsenate penetrated the

soil when applied to grass plots for the control of soil infesting insects. Two of the materials used were dry powders and the third a colloidal paste containing 40 per cent. water. Each was mixed with 5 parts of an organic fertiliser, 1 part of water being then slowly added, and applied to the various plots at the rate of 5 or 10 lb. dry or paste lead arsenate to 1,000 sq. ft. of surface. Two applications were made by hand, the second crosswise to the first, and the plots were then watered with a garden hose. Watering was continued at intervals so that the equivalent of about 2½–3 inches of rain had fallen on each plot before collection of soil samples for analysis, samples being taken at different depths from each plot at intervals between 20th June and 18th March. The method of sampling is described. It was definitely shown that the amount of lead arsenate entering the soil was proportional to the amount applied to the surface. No important differences were noticeable between the penetration of the three kinds of lead arsenate used, considerable penetration being observed in September 1929 and March 1930, and some lead arsenate being found to a depth of 12 inches in all the plots at the latter date.

Hamilton (C. C.). **The Toxicity of several Lead Arsenates to the different Instars of the Grubs of the Brown Garden Beetle.**—*Rep. New Jersey Agric. Expt. Sta. 1929–30*, pp. 192–200. New Brunswick, N.J., 1931.

Tests were carried out to determine the toxicity of the brands of lead arsenate used in the penetration tests recorded in the preceding paper to various stages of the larvae of *Aserica* (*Autoserica*) *castanea*, Arrow. The lead arsenates were mixed with two types of soil in amounts varying from the equivalent of 2½ lb. to 15 lb. to 1,000 sq. ft., to a depth of 1 inch. The first instar grubs were easily killed with the various amounts and kinds of lead arsenate in an average of 3–5 days, but the second instar ones were slightly more difficult to kill, the average time required varying from 3½ to 11 days and 2½ lb. taking twice as long as 15 lb. to produce an average kill. The third instar grubs required a considerably longer time than either of the others for a satisfactory kill to be obtained. More than half of them, however, were dead at the end of 9 days. In the tests against all the instars the colloidal paste, which contains 40 per cent. water, was slightly less toxic and took a longer time to kill than the dry powder.

McGregor (E. A.). **A new Spinning Mite attacking Raspberry in Michigan.**—*Proc. Ent. Soc. Wash.*, xxxiii, no. 8, pp. 193–195, 6 figs. Washington, D.C., November 1931.

Tetranychus mcdanieli, sp. n., is described from raspberry in Michigan. This mite appears at the time of harvest during dry seasons and causes practically the entire failure of the crop. The infested leaves become brown and slightly curled, and the fruit fails to develop properly during the latter part of the season. The leaves of the new growth are webbed together. The mites usually disappear soon after the crop is harvested. *Paratetranychus ilicis*, McGregor, is also recorded as attacking raspberry in Michigan.

Heinrich (C.). **A new Pine Moth from Connecticut.**—*Proc. Ent. Soc. Wash.*, xxxiii, no. 8, pp. 196–197. Washington, D.C., November 1931.

Eucosma gloriola, sp. n., is described from adults reared from larvae discovered feeding in the tips of twigs of white pine (*Pinus strobus*) in Connecticut.

Fisher (W. S.). **New Cactus Beetles. III.**—*Proc. Ent. Soc. Wash.*, xxxiii, no. 8, pp. 197–201, 2 refs. Washington, D.C., November 1931.

Moneiiema (*Collapteryx*) *crassipes*, sp. n., *M.* (*C.*) *aterrima*, sp. n. and *M.* (*C.*) *mundelli*, sp. n. are described from cactus [*Opuntia*] in Mexico.

Dozier (H. L.). **New and interesting West Indian Homoptera.**—*Amer. Mus. Nov.*, no. 510, 24 pp., 18 figs. New York, 15th December 1931.

Among the new species recorded are *Cicadella dubiosa*, on guava and coffee, and the Fulgorid, *Ormenis coffeacola*, on coffee, both from Haiti.

Ultée (A. J.). **Verslag over de werkzaamheden van het Proefstation Malang in het jaar 1930.** [Report of the Malang (Java) Experiment Station for 1930.]—*Meded. Proefst. Malang*, no. 80, 51 pp. Surabaya [1931.]

The coffee pests mentioned in this report include *Zeuzera coffeae*, Nietn., and the Geometrid, *Hyposidra talaca*, Wlk., which were very harmful in some plantations. The Hepialid, *Phassus damor*, Moore, is recorded for the first time from coffee (*Coffea robusta*). A Pyralid of the genus, *Mucialla*, previously unknown as a pest, was observed boring in immature beans. It does not seem to be a secondary pest, as is often the case with Lepidoptera infesting coffee beans.

Pests of green manures include *Xystrocera festiva*, Pasc., and *X. globosa*, Ol., on *Albizzia*, and the Chrysomelid, *Plagiodera inclusa*, Stål, on *Pueraria*. *Hyposidra talaca* infested coca [*Erythroxylon coca*] in many localities, and stored coca with the abnormally high water-content of 17·5 per cent. was attacked by the Tineid, *Setomorpha tineoides*, Wlk.

The following is taken from the report of the entomologist, J. G. Betrem (pp. 17–25). The importation, breeding and distribution of *Heterospilus coffeicola*, Schmied. [*cf. R.A.E.*, A, xiii, 467] against the coffee berry borer [*Stephanoderes hampei*, Ferr.] is being continued. Of more than 20 species of coffee twig-borers observed, *Xyleborus morigerus*, Bldf., and *X. morstatti*, Hag., are the most important. They have a pupal stage of 6–7 days. Pupae and some adults were found in the brood-mine 30 days after the female had bored into the twig, and many adults were seen after a further 12. Notes are given on the relation between these two species and their environment [xix, 568]. Other common twig-borers are *X. discolor*, Bldf., and *X. bicornis*, Eggers. A list is given of Coccids attacking coffee, the most

injurious being *Pseudococcus citri*, Risso, *Ferrisiana* (*Ferrisia*) *virgata*, Ckll., and *Coccus* (*Lecanium*) *viridis*, Green. Arrangements are being made to breed *Cryptolaemus montrouzieri*, Muls., for use against these scales in the dry season.

[Lebedev (A. G.) & Savenkov (A. [O.] N.).] **Лебедев (А. Г.) и Савенков (А. [О.] Н.). Contributions to the Study of the Biocoenosis of a Pine Forest.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, pp. 1–17, 1 graph, 2 refs. Leningrad, 1931.

This paper, which was originally published in Ukrainian, has already been noticed from a German abstract [*R.A.E.*, A, xix, 703]. The percentage of beneficial insects stated in the abstract to be 14·3 is here given as 14·13.

[Silant'ev (I.).] **Силантьев (И.). Contributions to a Monograph of *Tipula oleracea* L.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, pp. 29–45, 13 figs., 54 refs. Leningrad, 1931.

In 1928 and 1929, outbreaks of the crane-fly, *Tipula oleracea*, L., all stages of which are described, were widespread in Russia, severe damage being done to flax, oats and barley. A detailed account is given of its bionomics, based on the literature and on laboratory observations in Pskov in the summer of 1929. In this part of European Russia, the biology of the fly is similar to that in Germany and Scotland [*R.A.E.*, A, xi, 201; xiv, 462]. The adults are found from July to late September or early October, the eggs from the end of July to September, and the larvae from the second half of August to mid-July of the following year. Pupation, which takes place in the soil at a depth of about 2 ins., occurs from mid-July to September, the pupal stage lasting 10–25 days. A female may lay 118–884 eggs, this stage occupying 10–20 days, according to the temperature and degree of moisture. A list is given of the food-plants of the larvae. Under artificial conditions they can resist starvation for a considerable time, though it retards their development. Hibernation occurs in the ground at depths of 6–8 ins.

[Zorina (L. M.).] **Зорина (Л. М.). Contributions to the Biology of *Exapate congelatella* Cl.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, pp. 47–52, 7 figs., 1 ref. Leningrad, 1931.

In 1929 the Tortricid, *Exapate congelatella*, Cl., the egg, larva and pupa of which are briefly described, occurred in numbers on apples in the Leningrad Government, various bush fruits, willow and *Spiraea* being also attacked. In the laboratory the first adult appeared on 17th September, maximum emergence occurring between 5th and 11th October, though single individuals emerged as late as the beginning of November. In the field the moths were on the wing throughout October. From 80–160 eggs are laid singly or in groups on various parts of the branches, the oviposition period usually lasting about 5 days. Hibernation occurs in the egg stage, though eggs kept in a room at 17° C. [62·6° F.] hatched in December. In the spring the larvae attack the buds, leaves, flowers, and fruit, making large cavities in the latter. Pupation occurs from mid-June to the end of July. About 3 per cent. of the larvae and pupae collected in the field

were parasitised by *Meteorus pleuralis*, Ruthe, and *Pimpla examinator*, F., respectively.

The males should be trapped on adhesive bands, in the middle of which pupae of the females, which attract them on emergence, have been placed in small muslin bags, it being easy to distinguish the sexes in the pupae by differences in the structure of the last abdominal segment.

[Zorin (P. V.).] **Зорин (П. В.). Some Features of Reproduction and Fertility of** *Pteromalus puparum* **L.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, pp. 53–67, 4 figs., 6 refs. Leningrad, 1931.

This is an account of laboratory observations on the reproductive capacity of *Pteromalus puparum*, L., which in the Leningrad Government is an important parasite of *Pieris brassicae*, L., and especially *P. rapae*, L. The number of the offspring produced by individual females varied from 194 to 697, according to their size, unfertilised ones producing males exclusively. The host pupae that are attacked by a parasite towards the end of its life are not parasitised, though eggs are apparently laid in them ; this is probably due to some organic change in the poison gland of the parasite, the secretion of which serves to paralyse the tissues of the host until the parasite eggs have hatched. If the parasitised pupae are kept at temperatures of 22–25° C. [71·6–77° F.], all the parasites will emerge in one or two days ; the protracted period of the emergence of parasites from similar pupae in the field may be explained by fluctuations in the temperature. The anatomy of the female reproductive system of this parasite is discussed. The suggestion that polyembryony may occur in the eggs of *P. puparum* was not confirmed.

[Arkhangel'skaya (A.).] **Архангельская (А.). New Species of Scale Insects, Coccidae, from Central Asia.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, pp. 69–85, 14 figs., 2 refs. Leningrad, 1931.

Among the 9 new Coccids here described, in Russian and English, is *Drosicha turkestanica*, a widely distributed species on a number of food-plants, including mulberry, apricot, quince, apple, and the roots of vine. Hibernation occurs chiefly in the egg stage but also in the larval. In the spring the young larvae attack the roots of various grasses and later migrate to the leaves of bushes and trees. Adult females are difficult to find, as before oviposition, which probably takes place in July, they hide in cracks in the soil and bark and other shelters. The larvae are destroyed by those of a Coccinellid, *Scymnus* sp., which they closely resemble, and the adult females are parasitised by a fly, possibly *Cryptochaetum* sp. *Physokermes unifasciatus*, sp. n., is one of the most injurious Coccids in the Samarkand and Khodzhent districts (Uzbekistan), causing severe damage to peach and almond. It also occurs on wild almond and *Prunus prostrata*, so that it is probably indigenous. A female may lay 1,000–1,500 eggs, and these are deposited at the end of April and hatch at the end of May or beginning of June. There is one generation a year. Five species of parasitic Hymenoptera have been reared from the adult female, and the colonies are often destroyed by Coccinellids.

[Kazyakina-Vinogradova (V. N.).] **Казякина-Виноградова (В. Н.). Some results of the entomological Examination of Orchards in the Luga district of the Government of Leningrad.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, pp. 87–92. Leningrad, 1931.

A list is given of various pests collected in four orchards in the Leningrad Government from 1st June to 15th August 1929, with notes on their seasonal occurrence in the field and laboratory. They include *Cheimatobia brumata*, L., and *Exapate congelatella*, Cl., which were by far the most abundant on apple, the Aphid, *Anuraphis* (*Dentatus*) *communis*, Mordv., which has not previously been recorded from so far north, and the sawfly, *Pristiphora pallipes*, Lep., about 15 per cent. of the larvae of which were parasitised by the Tachinid, *Ptychomyia selecta*, Mg.

[Poroshina (V.).] **Порошина (В.). *Dysmilichia gemella* Leech, as a Pest of *Perilla frutescens* Brit. in the Russian Far East.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, pp. 93–97, 1 fig., 3 refs. Leningrad, 1931.

Perilla frutescens, which is cultivated in the Russian Far East for the production of oil, is severely infested by the Noctuid, *Dysmilichia gemella*, Leech, all stages of which are described. Laboratory and field observations near Vladivostock in 1929 showed that there is one generation a year. The adults emerge from overwintered pupae between 1st and 20th August. Eggs are laid singly or in groups of 2–3 at the base of the leaves near the inflorescences, or on the stems and opening flowers, about 20 being found on a plant. The larvae, which in the laboratory hatched in about 9 days, destroy the seeds only, feeding taking place at night. At the end of September they enter the soil to a depth of about ½–2 ins. and pupate, the pupal stage lasting about 10 months. Plants sown as late as 10th June were less infested than those sown one and two weeks earlier. The loss in the yield of seed in the infested fields is estimated to be about 43 lb. to the acre, representing about 14 lb. of oil.

The following control measures are recommended : autumn ploughing to a depth of about 4 ins., to expose the pupae and the larvae that are about to pupate ; late sowing of *P. frutescens* or cultivation of the grey variety, which is less attractive to the moth ; and spraying with a mixture of 1 lb. Paris green and 2 lb. unslaked lime in 100 gals. water, with the addition of a very small quantity of flour paste. This mixture does not scorch the plants and should be applied after they have flowered, a time when the larvae are numerous.

[Ion (O. I.).] **Ион (О. И.). On the Question of the Injuriousness of the Rye-thrips.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, pp. 99–101. Leningrad, 1931.

The author criticises Shchelkanovtzev's view as to the injury done to cereals by thrips [*R.A.E.*, A, xix, 285] and points out that that author only examined deformed plants. Observations in Latvia in 1925 showed that in the spring only overwintered adult females of the rye thrips, *Limothrips denticornis*, Hal., occur on rye, wheat and barley ; eggs are laid at the end of May inside the well developed apical leaf,

and the larvae probably hatch in about one week. Shchelkanovtzev described them as greenish-yellow, whereas the larva of the rye thrips is almost white with a large grey head, and this suggests that a different species must have been concerned. The larvae of *Frankliniella tenuicornis*, Uz., appear earlier than those of the rye thrips, individuals of the second instar being found on several occasions about 15th May in the leaf sheath of rye that had been deformed by *Chlorops taeniopus*, Mg. Examination of a number of healthy and deformed plants, chiefly of rye, showed that the presence or absence of the larvae or adults of thrips had no effect whatever on their condition; some well developed plants with a full ear harboured thrips, whereas unhealthy and deformed ones were not infested.

[Strel'tzov (I.).] **Стрельцов (И.). On the Biology of *Baris scolopacea* Germ.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, pp. 103–105, 1 fig., 1 ref. Leningrad, 1931.

Considerable damage to fodder beet was caused in September 1927 in a district of the Ekaterinoslav Government (Ukraine) by the larvae of the weevil, *Baris scolopacea*, Germ., which resulted in the withering of the leaves and roots. Varieties of beet the roots of which protrude from the soil were specially infested. All stages are briefly described. Laboratory observations showed that there is one generation a year, hibernation occurring in the larval stage. The first pupa was found on 8th June, and the pupal stage lasted 20–22 days. In the laboratory, the eggs, which were laid singly on the roots of beet at the end of August, hatched in 26 days. Dead larvae were found in about 40 per cent. of the infested beets collected in the field in September and in about 80 per cent. of those that were kept throughout the winter in the open and were covered with snow; in the latter case living individuals occurred only in the drier roots. Beet roots do not appear, therefore, to provide very suitable conditions for the hibernation of the larvae, though they evidently can survive there under certain unknown conditions. In April 1928, adult weevils were reared from larvae that had hibernated in the stems of *Chenopodium album*.

[Lyubomudrov (I. S.).] **Любомудров (И. С.). *Haplodiplosis equestris* Wagn. on Winter Wheat in Podolia.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, pp. 107–112, 3 figs., 27 refs. Leningrad, 1931.

As no information has been published in Russia concerning the midge, *Haplodiplosis equestris*, Wagn., since the first record of its occurrence there [*R.A.E.*, A, xv, 164], some account of its bionomics from the literature of other countries is given. Its distribution in western Ukraine is discussed, the damage caused there being usually negligible. The type of gall caused to the stems of wheat is described. Field observations from August 1926 to May 1927 showed that the majority of the larvae remain under the leaf sheath of wheat after harvesting. Larvae taken into the insectary at the beginning of August hibernated in damp sand close to the surface; two of them pupated about 18th April, and an incompletely developed adult was found dead in the oil on 1st May.

[Stark (V. N.).] **Старк (В. Н.). Ways of Forest Entomology.** [*In Russian.*]—*Plant Protection,* vii (1930), no. 1–3, pp. 135–138. Leningrad, 1931.

The shortcomings of existing works on forest entomology are discussed, and it is suggested that more study should be devoted to insect pests as constituting a negative factor in the life of forests, and to the damage caused. The relation between a tree and the insects that occur on it should be studied, as well as the reaction of trees to the injury and measures that would tend to increase their resistance. In the control of pests, prophylactic measures are of special importance, but a knowledge of these is possible only when the relation between tree and pest is understood. Two preliminary programmes are given for the study on a large scale and under local conditions of the damage caused by insect pests to forests in Russia.

[Nikol'skiĭ (V. V.).] **Никольский (В. В.). Quarantine Measures against foreign Cotton Pests in the United States of America and other Countries.** [*In Russian.*]—*Plant Protection,* vii (1930), no. 1–3, pp. 139–153, 1 ref. Leningrad, 1931.

The present state of cotton cultivation in the world is briefly reviewed, and emphasis is laid on the importance of insect pests, which cause enormous losses to the crop. The three chief pests, *Anthonomus grandis,* Boh., *Platyedra gossypiella,* Saund., and *Earias insulana,* Boisd., are dealt with separately, their history, geographical distribution and biology and the losses they cause being discussed. A brief account is given of the organisation and activities of the Federal Horticultural Board, by means of which quarantine regulations against cotton pests are enforced in the United States, and of the campaign against the spread of *P. gossypiella.* Other cotton producing countries in which legislation against cotton pests has been passed are also dealt with, and brief notes on their quarantine measures are given.

[Borodaevskiĭ (P.).] **Бородаевский (П.). Notes on the Biology of *Orthotomicus starki* Spess.** [*In Russian.*]—*Plant Protection,* vii (1930), no. 1–3, pp. 155–156. Leningrad, 1931.

Brief notes are given on the development of *Ips* (*Orthotomicus*) *starki,* Spess. [*cf. R.A.E.,* A, xv, 156], which was found at the end of May 1928 in a forest near Bryansk ovipositing in the thin upper branches of spruce felled in the preceding winter. It is estimated that about 41 per cent. of the larvae were destroyed, probably by those of their own species and of *Pityophthorus micrographus,* L., which infested the same branches. There was only one generation, young adults being found on 22nd September, but under natural conditions a second generation has been observed, the eggs and larvae hibernating.

[Borodaevskiĭ (P. P.).] **Бородаевский (П. П.). Bark-beetles in stored and fire wood in the Government of Bryansk.** [*In Russian.*] —*Plant Protection,* vii (1930), no. 1–3, pp. 157–159, 2 figs. Leningrad, 1931.

Observations have shown that bark-beetles may develop successfully in stacked coniferous fire-wood from which the bark has not been removed, and in spruce or pine poles used in forests for fences, the bark

of which has been only partly removed or left intact. Instances are given of the breeding under such conditions of *Ips* (*Pityogenes*) *chalcographus*, L., *I. typographus*, L., *I. duplicatus*, Sahlb., *I.* (*Neotomicus*) *proximus*, Eichh., *I.* (*N.*) *suturalis*, Gyll., and the Cerambycid, *Tetropium fuscum*, F., as well as of *Hylesinus fraxini*, Panz., in ash-logs. It is therefore important to bark all poles, logs, etc., of conifers or ash that are to be left in the forest throughout the summer.

[Trusov (N. P.).] **Трусов (Н. П.). Witch's Broom on red Clover caused by the Larvae of** *Apion seniculus* **Kirby.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, pp. 161–162, 1 fig. Leningrad, 1931.

In the summers of 1925–29 the development of red clover in a district of the Moscow Government was markedly retarded by infestations of *Apion* (*Catapion*) *seniculus*, Kby., which varied in different years from 2 to 9 per cent. Infested plants did not produce any seeds, and the yield of hay was considerably reduced. In 1929 the larvae, which occurred in the internodes of the stem, pupated in a few days, giving rise to adults on 8th July. The emergence of the weevils continued till mid-July. The injury caused is most serious in dry and hot summers.

[Arkhangel'skaya (T. A.).] **Архангельская (Т. А.). On the Occurrence of** *Eriocampoides limacina* **Retz., Males, in USSR.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, p. 167. Leningrad, 1931.

It has been stated in the Russian literature that *Caliroa* (*Eriocampoides*) *limacina*, Retz., is entirely parthenogenetic, the existence of males being unknown. In 1929, however, two males were observed in the Kirghiz Republic after two years' study of this species.

[Legatov (V. V.).] **Легатов (В. В.). An Attempt to control** *Colaphellus sophiae* **Schall.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, pp. 169–170. Leningrad, 1931.

An outbreak of the Chrysomelid, *Colaphellus sophiae*, Schall., on cabbage occurred in a district of Central Russia in May 1928, 75 per cent. of the seedlings being infested and, in some fields, about 50 per cent. of the plants being completely destroyed. Feeding took place during the day, the beetles hiding in the soil from 6–7 p.m. to about 10 a.m. Although spraying with Paris green, 1 lb. to 48 gals. water, caused an average fall in the number of beetles to a plant from 23 to 8 or 9, it did not prevent the spread of infestation. At the end of May dusting with calcium arsenite and chalk, 1 : 4, produced a marked decrease in the numbers of the beetles, and only a few occurred in the field two days later, numerous dead individuals being found on the ground and in the upper layer of the soil.

[Vereshchagin (V. A.).] **Верещагин (В. А.).** *Pyrausta nubilalis* **Hb. as a Garden Pest in the Amur District.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, p. 171. Leningrad, 1931.

In 1928 and 1929, *Pyrausta nubilalis*, Hb., caused severe damage in the Amur region to a number of cultivated crops. In orchards, fruits of apple and stems of raspberries were preferred, the latter usually being broken off at the point of entrance of the larva.

[Vorontzovskiĭ (P.).] **Воронцовский (П.). Notes on the Biology of *Argiope lobata* Pall.** [*In Russian.*]—*Plant Protection*, vii (1930 no. 1–3, p. 172. Leningrad, 1931.

Near the web of the spider, *Argiope lobata*, Pall., in a field near Orenburg, the remains of the following Orthoptera were found: *Calliptamus italicus*, L., *Oedaleus decorus*, Germ., *Celes variabilis* var. *subcoeruleipennis*, Charp., *Oedipoda coerulescens*, L., *Myrmeleotettix pallidus*, Br. W., *Chorthippus pulvinatus*, F. W., *C. albomarginatus*, DeG., *C.* (*Stauroderus*) *biguttulus*, L., *C.* (*S.*) *bicolor*, Charp., and *Omocestus haemorrhoidalis*, Charp.

[Lindeman (I. V.).] **Линдеман (И. В.). A Handbook for the Observation and Field Investigations of the Pests of Sugar Beet.** [*In Russian.*]—Kiev, Izd. NIS Soyuzsakh. [Pub. Sci. Inst. Sugar Trust], 1930. (Review in *Plant Protection*, vii (1930), no. 1–3, pp. 199–200. Leningrad, 1931.)

This handbook, which is of a preliminary character only and is intended for the use of entomologists working at field stations, contains instructions for a correct record of the habits of the chief pests of beet and of the reaction of the plants to the injury they cause. An outline of the work of field observers for the different months is given. A chapter deals with the methods of catching insects for the purpose of estimating their numbers, and another discusses the incidence in relation to weather of a number of insect pests, including *Aphis fabae*, Scop., *Cicadula sexnotata*, Fall., *Cassida nebulosa*, L., and various Elaterids, Tenebrionids and Melolonthids.

[Telenga (N. A.).] **Теленга (Н. А.). Biological Observations on *Schistocerca gregaria*, Forsk. in Khorezm in 1929.** [*In Russian.*]—*Izv. Khorezm. s.-kh. op. St.* [*Bull. Khorezm Agric. Expt. Sta.*], no. 6, 27 pp., 6 figs., 1 pl., 6 refs. Moscow, 1930. [Recd. November 1931.]

Swarms of *Schistocerca gregaria*, Forsk., from Persia and Afghanistan, invaded Turkmenistan, Uzbekistan and Khorezm (Khiva) about the end of May 1929. The locusts were sexually mature, and the swarms contained up to 96 per cent. of males. Oviposition took place immediately on arrival, preferably in sand and on the borders of sand hills. In some places, where the sand was sufficiently moist, the density of infestation was as high as 100 egg-pods per square metre. Hoppers appeared about the end of June and became adult about a month later. The new swarms flew away in a southerly direction.

The behaviour of hoppers is regulated mainly by the temperature, the mass migration of older hoppers taking place when the temperature of the air reaches 33–34° C. [91·4–93·2° F.], and that of the surface of the soil 40–48° C. [104–118·4° F.]. A temperature of 60° C. [140° F.] is fatal to the first stage hoppers.

Locusts of the second generation bred in open-air cages began to pair a month after becoming adult, and the females laid 150–240 eggs in 3–4 egg-pods. These hatched in about three weeks. The length of the incubation period depends on the temperature and on the moisture of the soil; in moist soil it was 16–17 days, as against 37 in dry. In very dry soil the eggs failed to hatch.

Changes in the colouration of hoppers, from the gregarious to the

solitary type, are easily produced in cages by crowding or isolation. Even adults produced from hoppers bred in densely populated cages, or taken from dense bands, assume the typical solitary colouration if isolated, and do not acquire the yellow colouration on becoming sexually mature, as is the case with the gregarious type. Locusts kept at night in a thermostat at 35–40° C. [95–104° F.], and during the day in cages with an average daily temperature of 31·6° C. [88·9° F.], became yellow in 7 days, and began pairing in 9. Those kept in a cage in the shade, at an average temperature of 20·2° C. [68·36° F.] during the first month and 18·4° C. [65·3° F.] during the second, remained of a wine-red colour, and the ovaries of the females were undeveloped.

Of cultivated plants, cotton, *Sorghum* and lucerne were attacked by the hoppers, and cotton, lucerne, *Eleagnus* and apricot by the adults. Wheat was entirely avoided. The hopper stage bred on lucerne occupied 37 days, as against 28–30 in the case of those bred on cotton or *Sorghum*. Some hoppers fed on lucerne produced adults after only 4 moults, but these were short-winged. Detailed descriptions are given of all stages, with measurements of adults of the two phases.

Adult locusts were attacked by the parasitic Sarcophagids, *Disjunctio balassogloi*, Portsch., and *Blaesoxypha schistocercae*, Rohd., and a fungus, *Fusarium acridiorum*.

Control measures included the use of poisoned baits, barriers and trenches. Damage to crops was slight.

At the end of June the Kara-Kalpak territory on the Amu-Darya river was invaded by swarms of another Acridid, *Dericorys albidula*, Serv., which, however, did not damage the crops.

Pickles (A.). **On the Oviposition of** *Tomaspis saccharina*, **Dist. (Rhynch., Cercop.) an Insect Pest of Sugar-cane in Trinidad.**— *Bull. Ent. Res.*, xxii, pt. 4, pp. 461–468, 1 fig., 13 refs. London, December 1931.

The possible relation between the number of eggs laid by *Tomaspis saccharina*, Dist. (sugar-cane froghopper) in Trinidad, and the character of the soil was investigated by means of comparing the egg populations in different types of soil around canes of comparable ages in different parts of the Island. The eggs were extracted from the soil by means of an apparatus similar to one previously noticed [*R.A.E.*, A, x, 527], and the soil samples were obtained either by skimming off a layer of the soil 6 ins. wide and 1 in. deep, or by removing sectors, 12 to each stool, the circumference of each sector being 6 ins. from the nearest cane stalk. Examination of soil samples taken from two fields of cane subject to severe attacks and grown on red and brown clay respectively, and another field grown on black marl reputed to be consistently free, showed very great differences in the egg populations. It is thought that such results are due to differences in soil characters that result in variations in the degree of injury according to the froghopper population directly, and not to the resistence of the canes as the result of growing in good soil. General experience during 1930 indicated that eggs were difficult to find in trash but were abundant in the soil, and comparative counts in one estate showed only 11 eggs in trash as compared with 698 in the soil, for all three broods. If these figures represent normal conditions, soil characters may reasonably be of paramount importance in determining froghopper distribution. The results will also have a significant

bearing upon agricultural practice in regard to the disposal of trash. Experiments to determine the relation between the eggs and the soil in which they are laid show that the egg is in intimate contact with the soil after laying, and it is reasonable to suppose that certain soils or conditions of soils are distasteful to ovipositing females and are therefore avoided, or may even render oviposition a mechanical impossibility. This intimacy of contact between egg and soil renders soil characters of prime importance in governing the hatching of eggs already present. In the air, froghopper eggs require a humidity corresponding to 90 per cent. for hatching and will doubtless need a soil-atmosphere humidity of this order, which will depend on weather conditions and also upon the water-supplying power of the soil. An examination of cane stumps and of soil from around stools showed that the eggs are normally laid in the surface soil, but not in close contact with the roots of the cane.

Although there is thus strong support for the theory that the production of froghopper blight is determined by the abundance of froghoppers and not by metabolic activity of the canes [*cf.* xiv, 619], it is admitted that recovery from a blighted condition after the cessation of froghopper attacks may be affected by the physiological relations of the cane, which in that case would partly govern economic loss. Moreover, since the abundance of froghopper eggs in the soil depends on its condition and nature, soil characters are directly responsible for determining the severity of blight.

SALT (G.). **Parasites of the Wheat-stem Sawfly, *Cephus pygmaeus*, Linnaeus, in England.**—*Bull. Ent. Res.*, xxii, pt. 4, pp. 479–545, 29 figs., 55 refs. London, December 1931.

An investigation of the parasites attacking *Cephus pygmaeus*, L., a sawfly well known as a pest of wheat in Europe for many years, was carried out in England in 1929 and 1930 with a view to introducing them into Canada against *C. cinctus*, Nort., which has recently become a serious pest of wheat in Manitoba, Saskatchewan and Alberta. The life-history of *C. pygmaeus* is briefly outlined, and lists are given of the 4 parasites recorded as attacking *C. cinctus* in western Canada and the United States, and of those known to attack *C. pygmaeus*, 7 species in the United States and 4, of which at least one or two are hyperparasites, in Europe. Details are given of the mass collection of *C. pygmaeus* effected for the investigation and of the examination of the collected material in 1929 and 1930. Of the 13 species collected from the material secured, the following 9 were primary parasites: *Hemiteles hemipterus*, F. (0·66 per cent. parasitism), *Leptocryptus bellulus*, Krchb. (0·02), *Microcryptus unifasciatus*, Schmied. (0·001), *Pezomachus fallax*, Först. (less than 0·001), *Gambrus tricolor*, Grav. (less than 0·001), *Pimpla detrita*, Holmgr. (2·12), *Collyria calcitrator*, Grav. (62·25), *Microbracon terebella*, Wesm. (2·77), and *Pleurotropis benefica*, Gahan (3·95). *Hemiteles inimicus*, Grav., attacks *H. hemipterus* as a secondary parasite, and the following are hyperparasites attacking *M. terebella*: *H. hemipterus*, *Pezomachus terebrator*, Ratz., *Eurytoma appendigaster*, Swed., and *Habrocytus* sp. The comparative values of the respective parasites are discussed, and a field key is given to facilitate recognition of the larvae as they are found in the stubble between September and April, as well as one designed to enable the investigator to discriminate easily between parasites likely to be reared from

Cephus material collected in England, which include, in addition to the 13 species found in the course of the study, 3 that do not attack *Cephus*. *C. calcitrator* was selected as the most suitable for introduction into Canada, and a brief account is given of its mass collection and shipment in 1930 and 1931.

Notes are given on the status of *Cephus pygmaeus* in England in 1929 and in a single field in 1930, with detailed descriptions of the adults and larvae of its five major parasites and information in regard to alternative hosts. A brief analysis of the factors contributing to the natural control of *C. pygmaeus*, based on observations covering only two winter seasons and infrequent field excursions during one summer, indicates that the abiotic factors take a very heavy toll of the sawfly population, but that they remain constant from year to year and are only very slightly amenable to human modification. *Collyria calcitrator* is considered the most important single factor in the control of *C. pygmaeus* in England, and provided that this parasite is present, the absence of even the best of the other parasites produces little effect on the numbers of the host. In view of the very high frequency of *C. calcitrator* in England, its perfect adaptation and complete concentration on the wheat-feeding Cephids, its independence of alternative hosts and its ability to exist under very different climatic conditions, the introduction of this parasite is likely to have a very beneficial effect on the infestation of *C. cinctus* in Canada.

Smith (C. W.). **Colonisation in Canada of** *Collyria calcitrator* **(Hym. Ichn.), a Parasite of the Wheat-stem Sawfly.**—*Bull. Ent. Res.*, xxii, pt. 4, pp. 547–550. London, December 1931.

A shipment from the Imperial Institute of Entomology of 15,000 wheat stubs containing *Cephus pygmaeus*, L., parasitised by *Collyria calcitrator*, Grav., collected during the winter of 1929–30 in England, was sent to Canada on 20th March 1930. Details are given of the packing and transport of the consignment, which was sent in cold storage (40° F.) from Southampton to Montreal and reached Belleville laboratory on 2nd April. It was kept in cold storage (32–40° F.) until it was forwarded to the centre selected for emergence on 13th June, the material being spread out on trays in a safety cage. Emergence began almost immediately and continued until 7th July, a total of 6,323 adults of *Collyria*, about 60 per cent. of which were females, being reared. The peak of emergence (1,386 individuals) was reached on 23rd June, before the adults of *C. pygmaeus* had begun to appear in large numbers. Numerous adults of other species emerging from this material were killed as soon as they were observed. The results of two tests with adults emerging from material retained at Belleville, to determine the ability of *Collyria* to withstand shipment as adults, were inconclusive, but the first consignment, which took 3 days to reach its destination, suffered only 8 per cent. mortality, and the parasites when released appeared normally active and vigorous.

Details are given in regard to type of wheat and degree of infestation in fields chosen for the liberation of the parasites, which was begun on 17th June, the final liberations being made on 30th June. Females were observed shortly after liberation ovipositing through the wheat stems, and eggs of *Collyria* were found in attacked eggs of *Cephus cinctus*, Nort., but not in the larvae. It is thought that the parasite

locates the host egg by thrusting its ovipositor through the scar left by that of the host. Collections of infested stubble at harvest made at the points of liberation showed an apparent reduction in sawfly infestation, and parasites contained in larvae of *C. cinctus* were identified as *Collyria calcitrator*. The establishment of the parasite was most successful in the field where it was liberated earliest. The chances of its survival were found to be greatest in stems that contain eggs only and not larvae, as the oldest host larva present devours the younger larvae and eggs, whether parasitised or not, and it is, therefore, proposed to make earlier liberations in future.

LEAN (O. B.). **The Effect of Climate on the Migrations and Breeding of *Locusta migratorioides* in Nigeria.**—*Bull. Ent. Res.*, xxii, pt. 4, pp. 551–569, 8 figs., 7 refs. London, December 1931.

In a previous paper on the swarming of *Locusta migratoria migratorioides*, Rch. & Frm., in tropical Africa [*R.A.E.*, A, xix, 709], it was shown that the flights kept within three vegetation belts, *viz.*, high grass—low tree savannah ; acacia—tall grass savannah ; and acacia—desert grass savannah. To these a fourth, the " mountain grass " belt should be added. It appears, however, that the range of this locust does not depend so much on the vegetation as upon the climatic conditions peculiar to each of the vegetation belts, which themselves are only the indicators of the suitable climatic zone. Within the wide area covered by the foregoing types of vegetation, the movements and behaviour of the swarms are influenced by various climatic factors, and an attempt is made to correlate the main movements and breeding seasons of locusts in Nigeria with the seasonal climatic changes from December 1929 to April 1931.

An outline of the infestation of Nigeria, by periods, is given, with brief descriptions of the vegetation, orography and climate. The analysis of the correlation between the movements of locust swarms (about 2,300 records of which were available) and climatic conditions, suggests that humidity, precipitation and wind are the relevant climatic factors, temperature apparently being of no importance. It is considered that the area of dispersal is limited by the humidity factor, since the swarms, with very few exceptions, remain where the mean relative humidity as recorded at 9 a.m. is not more than 85 per cent., and not less than 40 per cent., and most swarms are found where the humidity is from 60 per cent. to 80 per cent. This humidity belt coincides with the area covered by the three main types of vegetation, and the swarms move across the belt according to the seasonal changes in humidity in its respective parts.

The wind does not appear to be of primary importance in determining the general direction of migrations, but within the preferred humidity belt, the dispersal of swarms is probably influenced by winds. Thus, during the primary spread of swarms through Nigeria, the general northward movement was probably due to the humidity gradient, while the eastward migration was probably due to the prevailing winds.

The relation of breeding seasons to climatic changes has also been analysed, with the aid of climatographs. Breeding does not commence after the dry season until the humidity rises to 60 per cent. and the monthly degree of wetness (the total monthly rainfall multiplied by the number of days on which more than 0·01 in. rain has fallen, and divided by 10) reaches 2. On the other hand, breeding does not occur if the

humidity is above 80 per cent. Through the dry season the adults seem to be unable to live for more than 22 weeks, and if optimum conditions are not reached within that period, death may occur. Breeding towards the end of the rainy season occurs some 11 to 15 weeks after the locusts become adult, so long as the humidity is not above 80 per cent., and higher humidity may cause a diapause. Suitable local conditions during the dry season may allow a third breeding season.

These conclusions may be utilised : (1) to delimit the total area likely to be infested ; (2) to forecast when the different zones will be infested by flying swarms ; (3) to forecast whether and when breeding is likely to occur in each locality ; (4) to check whether unidentified swarms were of this species of locust ; and (5) to test the possibility of one suspected breeding ground having been infested from another.

Lean (O. B.). **Notes on the Breeding of** *Nomadacris septemfasciata* **(Orth., Acrid.) on the Shores of Lake Chad.**—*Bull. Ent. Res.*, xxii, pt. 4, pp. 571–572. London, December 1931.

Hoppers of *Nomadacris septemfasciata*, Serv., were observed swarming in Nigeria on the western shore of Lake Chad during August and September 1930. The hopper bands were concentrated mainly in the " marsh grass " association and were not as dense as those of *Locusta migratoria migratorioides*, Rch. & Frm., becoming diffuse in the later instars. Both hoppers and adults seemed to feed entirely on graminaceous plants. The hopper stage lasted about seven to eight weeks, the first adults appearing at the end of September, when they caused considerable damage to maize, the cobs, as well as the leaves, of which were eaten. Recently winged swarms undertake only irregular circular flights, but definite migration flights were reported in October. A description of the fourth stage hopper is given.

Tucker (R. W. E.). **Sugar-cane Borers. The Mass Breeding of** *Trichogramma minutum* **to control** *Diatraea saccharalis* **in Barbados during 1930.**—*Trop. Agriculture*, viii, no. 11, pp. 283–288, 9 pls., 10 refs. Trinidad, November 1931.

Preliminary accounts of the mass-breeding and liberation of *Trichogramma minutum*, Riley, against *Diatraea saccharalis*, F., on sugar-cane in Barbados have already been noticed [*R.A.E.*, A, xvii, 614 ; xix, 105]. During 1930, over 43½ million parasites were reared at a total cost of £1,330. The technique and apparatus employed are discussed. It has been observed that the more frequent and widespread the liberations of parasites, the more effective the control over the area concerned. The procedure in liberating the parasites is to establish them as early as possible throughout the young growing crop and to maintain a parasitism above normal over a period of several months. At least 2,100 parasites are evenly distributed per acre at each liberation, at the rate of one cardboard slip containing about 170 parasitised eggs to every tenth cane stool, chessboard fashion. In addition to the liberations made in 1929 and 1930 [xix, 172, 720], over 2 million parasites were liberated during January and February 1931. When heat was used to free grain used for breeding *Sitotroga* [*cerealella*, Ol.] (the laboratory host) from pests [*cf.* xix, 105], the moisture content of the grain was so reduced that fewer and smaller

moths were reared. Fumigation with an overdose of hydrocyanic acid gas for 2–3 days, however, did not interfere with the breeding, and, together with the use of sulphur at the rate of 5 lb. to 3,500 lb. grain, has resulted in the destruction of all pests other than *Tribolium castaneum*, Hbst. (*ferrugineum*, F.). This beetle, which increases rapidly and is difficult to exclude, is capable of causing considerable damage [*cf.* xix, 490]. The beetles tend to congregate in dark confined spaces and may be destroyed by being swept from under boards placed on the floor of the insectary and other hiding places into receptacles containing oil emulsion. The floors should also be occasionally washed with a hot 5 per cent. carbolic solution.

In order to evaluate the results obtained from liberations of parasites, it is necessary to estimate the host population week by week over a period of several months and, simultaneously, to ascertain the extent of parasitism by *Trichogramma*; in addition, the total damage caused by the pest at the period of reaping must be assessed annually. The estimation of the host population is made by weekly or fortnightly collections and counts of the eggs at as many points as can be regularly visited over the Island. While the cane is still young, counts of dead hearts per 100 stools are made in fields selected at random; the figures thus obtained are an index of moth prevalence. The extent to which cane is infested by borers at the time of reaping is ascertained by careful counts of damaged and undamaged joints in numerous samples selected from about 60 different estates throughout the Island. From the percentage of joints bored the factory loss is obtained, and this when added to the field loss gives the total to a fairly accurate degree for the area treated. Owing to a number of factors, such as meteorological conditions, variety of cane, conditions of the soil and stage of growth at which estimation is made, an accurate estimation is hardly possible, unless a large percentage of samples from every field in the whole Island is examined. The total loss in the crop harvested in 1931 was 16·6 per cent. as against 20·85 per cent. in 1930 [*cf.* xix, 105].

JARVIS (H.). **Cabbage Moth Control by non-arsenical Sprays.**—*Queensland Agric. J.*, xxxvi, pt. 4, pp. 399–403. Brisbane, 1st October 1931.

During recent years, *Plutella maculipennis*, Curt., has caused serious damage to cabbages in parts of Queensland, and as spraying with lead arsenate has not given satisfactory control, various alternatives were tested. One plot was treated with a proprietary derris preparation, at the rate of 2 lb. to 40 gals. water, and a second with a spray composed of ½ pt. nicotine sulphate, 2 lb. soap, 1 lb. lead arsenate and 40 gals. water, four applications being made in each case. Both materials gave fairly satisfactory control, but the former was more toxic to both larvae and pupae, and the plants treated with it were cleaner and better grown. In addition to its greater efficacy, it has the advantage of being non-poisonous to man.

FOWLER (R.). **Codlin Moth Control Experiments, Blackwood, 1930-31.**—*J. Dept. Agric. S. Aust.*, xxxv, no. 3, pp. 306–314. Adelaide, 15th October 1931.

Experiments against the codling moth [*Cydia pomonella*, L.] in 1929–30, a full report of which has already been noticed [*R.A.E.*,

A, xix, 468], were repeated during 1930–31, several new spray materials being also tested. The results of these tests, which in most cases had been carried on over two years, are disappointing in that treatments that tend to give more efficient control generally appear to result in an increased arsenical residue, and where more efficient control was obtained with reduction in arsenical residue there was a corresponding depreciation in colour and appearance of the fruit. The results from treatments in 1930–31 when there was a light crop of fruit were not as good as in 1929–30 when the crop was a heavy one. The spray injury resulting from the use of summer oils alone may possibly be connected with conditions due to low moisture content in the soil. The use of adhesive bands is recommended subject to examination at intervals not exceeding 10 days. Bait traps in which molasses, at a strength of 1 in 10, is used as the attractant may be employed as reliable indicators of maximum emergence periods and of the best time to apply sprays.

Atkinson (N. J.). **The Increase of Native Insects to Economic Importance in the Prairie Provinces.**—*Sci. Agric.*, xii, no. 4, pp. 200–203, 8 refs. Ottawa, December 1931.

The principal insect pests of field crops in western Canada are indigenous species, probably owing to the comparatively recent development there of agriculture and to the extreme climatic conditions, similar only to those in Russia. The causes of increase of the following species in this region are discussed: *Euxoa ochrogaster*, Gn. (red-backed cutworm), *Porosagrotis* (*Agrotis*) *orthogonia*, Morr. (pale western cutworm), *Cephus cinctus*, Nort. (wheat-stem sawfly), *Corymbites* (*Ludius*) *aeripennis tinctus*, Lec. (prairie grain wireworm) and Acridids, the most common of which are *Camnula pellucida*, Scud. (clear-winged grasshopper), *Melanoplus mexicanus*, Sauss. (lesser migratory grasshopper) and *M. femur-rubrum* DeG. (red-legged grasshopper). Control by biological means presents various difficulties, and cultural methods based on an ecological study of the insects concerned, both in their native habitats, when known, and in cultivated fields, must, therefore, be adopted. The author considers that the majority of noxious insects have become so owing to the changing of one or more factors in their environment bringing it closer to the optimum for the species concerned, rather than to any innate change in their habits.

[Hussain (M. A.).] **Annual Report of the Entomologist to Government, Punjab, for the year ending 30th June 1930.**—Fol., 46 pp. Lahore, Punjab Dept. Agric., 1931.

Notes are given on the pests occurring in the Punjab during the year 1929–30, some of which have already been recorded in previous reports [*cf. R.A.E.*, A, xix, 52, etc.], with the results of investigations on the bionomics and control of some of the more important. Parasites of *Earias* spp. reared from various stages of the moths collected in cotton fields [*cf.* xiv, 423; xvi, 419] included *Melcha nursei*, Cam., from the cocoons. Studies on the effect of temperature on the development of *Platyedra gossypiella*, Saund., show that when placed in incubators in January at 15° C. [59° F.] the larvae hibernate and do not pupate, at 20° C. [68° F.] emergence chiefly occurs during April and May, at 25° C. [77° F.] it starts a little earlier and continues till the end of

July, and at 30° C. [86° F.] the moths begin to appear much earlier, maximum emergence being over before May. The optimum temperatures for oviposition were found to be 20–25° C., females laying as many as 76 eggs each. Further studies on the bionomics of *Bemisia gossypiperda*, Misra & Lamba [*cf.* xix, 253] from 1st March 1929 to the end of January 1930 showed that 12 generations may occur in a year. At the beginning of the season parasitism did not exceed 2·5 per cent. By September, however, it had risen to 33·8 per cent., again dropping to a low percentage with the approach of winter.

Observations on *Pyrilla perpusilla*, Wlk., *P. aberrans*, Kby., and *P. pusana*, Dist., on sugar-cane show that all stages occur in the fields from April to December. After the crop is harvested the nymphs, which at this period are practically the only stage present in the field, adults being rare and oviposition having ceased, migrate to cereals and wild grasses, returning to the sprouting sugar-cane during the latter part of April. A list is given of the alternative food-plants of these Lophopids, with a table showing the effect of infestation on sugar-cane as determined by chemical analysis. The parasitism of these species by *Dryinus pyrillae*, Kieff., was highest during October–November, being 6·2 per cent. Eggs of *Pyrilla* collected from fields in one locality during September–December 1929 were found to be heavily parasitised by Encyrtids, the percentage varying from 9·3 to 24·5.

Investigations on *Schoenobius bipunctifer*, Wlk. (rice-stem borer) included experiments with light traps, which show that the moths are most numerous during August and September.

Morris (H. M.). **Annual Report of the Entomologist for 1930.**—*Ann. Rep. Dept. Agric. Cyprus 1930*, pp. 48–55. Nicosia, 1931.

Notes are given on a number of pests observed in Cyprus during 1930, some of which have already been recorded in previous reports [*R.A.E.*, A, xviii, 4 ; xix, 81]. A white oil emulsion gave satisfactory results against *Chrysomphalus aurantii*, Mask., at the end of the growing season on young *Citrus* trees, but this method should not entirely replace fumigation, which is safer and more effective, though more costly. Nicotine sulphate, used either as a dust or a spray, gave satisfactory results against *Aphis rumicis*, L., which caused considerable injury to beans early in the season. Late sown and late maturing cotton was particularly severely attacked by *Platyedra gossypiella*, Saund., and *Earias insulana*, Boisd., the damage to early maturing cotton being slight. Other pests included *Ceratitis capitata*, Wied., which was more than usually abundant on *Citrus*, *Rhaphidopalpa* (*Aulacophora*) *foveicollis*, Lucas, the adults of which damaged the leaves of melons, and *Lampides baetica*, L., which attacked immature French beans. An order regarding *Syringopais temperatella*, Led., was issued, under which no land declared infested by this moth may be used for the cultivation of wheat, barley, oats or rye for a period of 2–4 years.

Cunningham (H. S.). **Report of the Plant Pathologist, 1930.**—*Rep. Dept. Agric. Bermuda 1930*, pp. 33–39. Hamilton, 1931.

Injury to *Juniperus bermudiana* by a species of *Chrysomphalus*, believed to be new to science, was reported in Bermuda in 1930. This

Coccid is comparatively inconspicuous, and in minor infestations is present only at the base of the leaves. It has been found to be widely distributed throughout the Colony, a fact which indicates that it is not of recent introduction. In experiments soluble lime-sulphur has given satisfactory results, though this spray is not practicable as a general control measure owing to the wide distribution of this tree and its dense growth.

During November and December, cabbage and other cruciferous crops were badly damaged by *Phytometra* (*Autographa*) *brassicae*, Riley. This Noctuid may be controlled by arsenical sprays containing soap or some good adhesive. The foliage and fruit of tomato were also severely attacked. *Lygus pratensis*, L., caused serious injury to celery in fields and seed-beds, which in all cases were adjacent to fields covered with badly infested weeds. Infestation is also probable when celery is grown in close proximity to fields of sweet potato. The examination of many fields and bulbs indicate that the bulb mite [*Rhizoglyphus hyacinthi*, Banks] is prevalent in the lily fields. Severe injury to sweet pepper [*Capsicum*] resulted from the attacks of leafhoppers which were plentiful throughout the season.

Power (J. H.). **The Genus *Bufo* as an Economic Asset.**—*S. Afr. J. Sci.*, xxviii, pp. 376–377. Johannesburg, November 1931.

In a test to determine the food of *Bufo regularis*, one individual devoured in four nights 147 adults of the Melolonthid, *Schizonycha tumida*, Cast., a pest of the leaves of rose trees. An examination of the stomach contents of thirty museum specimens showed that insects form 99·6 per cent. of the food of this toad.

Investigations on the Spike-disease of Sandal. III.—20 pp. Bangalore, Indian Inst. Sci., 1931.

Some of the results of experiments conducted by the Indian Institute of Science during the quarter ending 30th September 1931 are discussed by A. V. Varadaraja Iyengar (pp. 15–18). The chemical analysis of leaves of sandal [*Santalum album*] that had developed symptoms of a disease as a result of the feeding of *Sympiezomias cretaceus*, Faust, previously fed on leaves infested with spike disease [*R.A.E.*, A, xix, 651], showed an unaccountable increase in the amount of nitrogen present. Moreover, the ratio of calcium to nitrogen was higher than in a plant attacked by spike disease. Microscopical examination did not reveal the accumulation of starch in the leaves that is usually present in diseased sandal.

Quaintance (A. L.), Newcomer (E. J.) & Porter (B. A.). **Lubricating-oil Sprays for use on dormant Fruit Trees.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 1676, 18 pp., 15 figs., 1 ref. Washington, D.C., September 1931.

A general account is given of the methods of preparing, storing and applying lubricating oil emulsions for use during the dormant period, the constituent oils being specified and their properties indicated.

Mixtures of oil with other materials in sprays, the effect on the trees and the orchard pests that may be readily controlled by oil sprays are discussed, the strength of the emulsion necessary for each species being indicated.

Beckwith (C. S.). **Report of the Cranberry Substation for 1930.**— *Proc. 61st Ann. Mtg. Amer. Cranb. Gr. Ass.*, pp. 17–19. Toms River, N.J., 1931.

Owing to unusual drought during 1929 and 1930 in New Jersey, the numbers of the cranberry girdler [*Crambus hortuellus*, Hb.] on cranberry bogs definitely increased. To check the continued spread of false blossom disease, it is essential to control leafhoppers while the plants are still in good condition. On bogs that are bearing, flooding for 12 hours about 10th June is the most satisfactory method of control. On newly planted bogs flooding on 20th June and again on 7th July ought to be sufficient to control leafhoppers, and before the plants have grown together, all that show false blossom injury should be uprooted. When flooding cannot be practised, spraying should be resorted to [*cf. R.A.E.*, A, xviii, 352], all the foliage being wetted on both surfaces in order to reach the leafhoppers ; a single spray should kill 95 per cent. of the insects when they are numerous.

Compere (H.). **New Encyrtid (Hymenopterous) Parasites of a** *Pseudococcus* **Species from Eritrea.**— *Univ. Calif. Pub. Ent.*, v, no. 14, pp. 265–274, 3 figs., 1 ref. Berkeley, Cal., 25th November 1931.

In the course of investigations in Eritrea on the parasites of *Saissetia oleae*, Bern. [*R.A.E.*, A, xix, 411], small colonies of *Pseudococcus citri*, Risso, were taken on the fruit of wild olive, *Olea chrysophylla*, during March and April 1930. The rarity of this pest is directly attributable to biological control, and an attempt was made to obtain its parasites for introduction into California. Of the eight species of parasites reared, *Leptomastix abyssinica*, sp. n., appeared to be the most efficient ; with each successive generation the ratio to that of the other parasites increased, and as it was the most numerous species in the first generation, the indications are that it is probably intrinsically and extrinsically superior [*cf.* xvii, 653]. Two undetermined species of *Anagyrus* were next in numbers, and *Neodiscodes martinii*, gen. et sp. n., *Tropidophryne africana*, gen. et sp. n., *Pseudaphycus* sp. and individuals of an unrecognised genus were comparatively rare. A species of *Leptomastidea* was also observed. Two species of *Cheiloneurus*, supposedly hyperparasitic, were destroyed as they appeared.

Repeated efforts were made at Riverside in July and August 1930 to propagate *L. abyssinica* on Californian examples of *P. citri*, but though oviposition occurred on this species, as well as on *P. maritimus*, Ehrh., *P. gahani*, Green, and *Phenococcus gossypii*, Towns. & Ckll., none of these hosts proved susceptible. Though the Eritrean and Californian forms of *P. citri* are indistinguishable taxonomically, the failure of the eggs of *L. abyssinica* to develop (they were destroyed by phagocytosis) shows that two biological races exist. If the strain found in Eritrea is that damaging commercial crops in other parts of the world, the discovery of effective parasites of it will be of economic value.

Holloway (J. K.). **Temperature as a Factor in the Activity and Development of the Chinese Strain of** *Tiphia popilliavora* **(Rohw.) in New Jersey and Pennsylvania.**— *J. N. Y. Ent. Soc.*, xxxix, no. 4, pp. 555–564, 1 pl. New York, December 1931.

Although individuals of *Tiphia popilliavora*, Rohw., from Japan, China and Korea are taxonomically alike, it has been more practical, owing to their biological differences, to consider them as three separate strains. The Japanese strain is at present considered one of the most promising parasites of *Popillia japonica*, Newm., but no recoveries have yet been made from the liberations of 2,192 females of the Chinese strain made in southern New Jersey and eastern Pennsylvania during 1927 and 1928. A study of the Chinese strain carried out at Moorestown, New Jersey, in 1928 and 1929, showed that the optimum temperatures for mating are between 65 and 75° F. The average length of life for adults was 22·77 days when kept at a constant temperature of 68° F. Observations indicate a predominating tendency to a one-year cycle, with emergence early in October, when only 10 of the 22 days of life would be favourable for mating. The soil temperatures in October do not inhibit oviposition, but will hold this activity at a minimum. The average mean soil temperature at 3 ins. during October from 1924 to 1929 was 55·2° F. Rearing experiments under natural conditions showed that temperatures under 60° F. are very unfavourable to the development of the parasitic larvae and to cocoon formation. The mean soil temperatures during the developmental period are 59·8° F. at 6 ins. and 59·7° F. at 9 ins.

The records obtained of the fecundity, the development of parasitic larvae on the host, and the percentage of adult emergence would indicate that the Chinese strain of *T. popilliavora* may become a factor in the control of *P. japonica* in infestations occurring south of New Jersey and Pennsylvania, but in the present latitude of heavy infestation of the Japanese beetle, the existing climatic conditions at and after the time of emergence are not favourable to adult activity, or to the development of eggs and larvae of the parasite.

Osburn (M. R.). **Effect on certain fresh Fruits of Fumigation with Ethylene Oxide to destroy the Japanese Beetle.**— *J. N. Y. Ent. Soc.*, xxxix, no. 4, pp. 567–575, 7 charts, 5 refs. New York, December 1931.

Experiments with ethylene oxide, which has been used with success against various pests of stored products [*R.A.E.*, A, xvii, 87; xviii, 407], have shown that this fumigant, which is non-injurious to the fruit and less inflammable and explosive than carbon bisulphide [xviii, 687], when used at the rate of 2 lb. to 1,000 cu. ft. for two hours at 75° F. will destroy adults and larvae of *Popillia japonica*, Newm., in boxes of fresh fruit, and adults of *Leptinotarsa decemlineata*, Say, and *Epilachna corrupta*, Muls., in wire-screen cages. No appreciable damage was caused under the conditions of these experiments to raspberries and blackberries, but blueberries suffered slightly and wet, green bananas, as well as the foliage of *Azalea* and *Hydrangea*, were severely injured.

Experiments with ethylene oxide as a soil fumigant against *P. japonica* showed that when balls of soil 6 ins. in diameter were treated

at 80 F., a concentration of 2 lb. to 1,000 cu. ft. for 3 hours destroyed all the larvae buried in them and 7½ lb. for 2 hours also killed 100 per cent. In similar tests with balls of soil 14 ins. in diameter, 10 lb. ethylene oxide killed the larvae in 3 hours.

PIERCE (W. D.). **A List of the Sugar Cane Insects of Negros Occidental.** —*J. N.Y. Ent. Soc.*, xxxix, no. 4, pp. 577–586. New York, December 1931.

The insects recorded in this list were collected from August 1927 to March 1930, and are grouped according to the nature of the damage they do, their natural enemies being given.

REX (E. G.). **A Wire Beetle Receptacle for Japanese Beetle Traps.**— *J. N.Y. Ent. Soc.*, xxxix, no. 4, pp. 593–594, 2 pls. New York, December 1931.

Illustrations are given of a detachable, rigid, wire mesh receptacle, of 3 U.S. qts. capacity designed to replace the glass jar hitherto used in the standard trap for the Japanese beetle [*Popillia japonica*, Newm.] [*R.A.E.*, A, xvii, 421 ; xix, 354]. After a thorough trial during 1931, its advantages were seen to be greater capacity without appreciable addition of weight, obviation of the necessity for cleaning, and delay in the appearance of decomposition odours for several days after capture, owing to aeration of the mass of captured beetles.

SCOTT (L. B.). **Manure Piles and Feed Lots as Sources of European Corn Borer Reinfestation.**—*Circ. U.S. Dept. Agric.*, no. 194, 13 pp., 4 figs., 1 ref. Washington, D.C., November 1931.

The following is taken from the author's summary : Investigations during 1927–29 in Ohio and New York on the survival of the larvae of *Pyrausta nubilalis*, Hb., in infested maize stalks in manure heaps are discussed. The results show that the larvae migrate in large numbers from the heaps, covering distances of up to 25 ft., and give rise to adults that are capable of infesting the new crop of maize. Infested material should therefore be kept away from manure heaps, and any manure containing such material should be ploughed under early in the spring before the larvae begin to migrate in large numbers. In further tests in which infested stalks were fed to cattle and pigs in an enclosure during the winter and spring, and the uneaten portions left to be trampled on by the animals, practically all the larvae were destroyed.

GINSBURG (J. M.). **Powdered Skimmed Milk is a good Spreader for Sprays.**—*New Jersey Hort. Soc. News*, 1931, p. 379. New Brunswick, N.J., March 1931.

Powdered skimmed milk is considered a very good spreader in lead arsenate sprays. As it contains no free lime there is no danger of calcium carbonate being formed or of water-soluble arsenic being freed. With lead arsenate and without lime, it can safely be used on apple foliage, but lime should be added when used on peaches in the proportion of 2 lb. lead arsenate and 12 lb. hydrated lime to 100 U.S. gals. Skimmed milk can be obtained very cheaply, and there are several powdered forms on sale. For spraying purposes one produced by the spray-drying system (rather than the film drying

system) is preferable. It must be very fine and completely soluble in cold water and should be practically free from moisture. The solubility of milk powder diminishes with age, and it is advisable to store it in air-tight containers to avoid absorption of moisture from the atmosphere. For spraying, the powder should first be worked into a smooth paste with water ; this paste should then be thinned with more water and transferred to the tank while the agitator is running. About 3 lb. of soluble skimmed milk powder to 100 U.S. gals. of spray are usually sufficient for satisfactory spreading in orchard sprays.

DRIGGERS (B. F.). **Parasites aid in Control of Oriental Peach Moth.**—*New Jersey Hort. Soc. News*, 1931, p. 380. New Brunswick, N.J., March 1931.

The oriental peach moth [*Cydia molesta*, Busck] has shown a steady increase in destructiveness in every area in New Jersey in which it has appeared, until an average of about three-fourths of the fruit in each section has become infested. Seasons of heavy infestation generally alternate with one or more seasons of light injury. Parasites, of which many are valuable aids in control [*R.A.E.*, A, xix, 475], destroy an average of 50 per cent. of the larvae in the twigs. Of these, 90 per cent. were attacked by *Macrocentrus ancylivora*, Rohw., in southern New Jersey during the past six years, *Glypta rufiscutellaris*, Cress., being almost as important in the northern part of the State during 1925–27. The latter has recently declined in importance, its place being taken by *M. delicatus*, Cress., and *Pristomerus ocellatus*, Cush. Parasites have been transferred to sections of the State where they were scarce with considerable success, particularly in the case of *M. ancylivora*, and consignments have also been sent to other States.

PRIESNER (H.). **Notes on a Hymenopterous Egg-parasite of** *Nezara viridula*, **L.**—*Bull. Soc. R. ent. Egypte*, 1931, fasc. 3–4, pp. 137–139, 3 figs. Cairo, 1931.

The author has found egg-masses of *Nezara viridula*, L., in Egypt, parasitised to the extent of 100 per cent. by the Scelionid, *Microphanurus megacephalus*, Ashm. This parasite has been recorded, under the genus *Telenomus*, as infesting the same host in Florida in 1928 [*R.A.E.*, A, xvi, 601], having been originally described from the West Indies. As *N. viridula* is not considered a pest in Egypt and no other parasite of it has been bred there, the indications are that *M. megacephalus* is of considerable economic importance. It is not known whether it is indigenous to Egypt, nor how long it has occurred there. It is possible that it also occurs in Palestine.

CARMIN (J.) & SCHEINKIN (D.). **The Fauna of Palestinian Plants : 2.** *Ficus sycomorus* **Linné.**—*Bull. Soc. R. ent. Egypte*, 1931, fasc. 3–4, pp. 164–187, 78 figs., 2 diag. Cairo, 1931.

Examination of thirty trees of *Ficus sycomorus* near Tel-Aviv revealed the presence of *Asterolecanium pustulans* var. *sambuci*, Ckll., *Pseudococcus lilacinus*, Ckll., and a number of minor pests, on the trunk and branches ; *Pauropsylla* spp., the numbers of which were

kept down by a parasite of the genus *Tetrastichus*, *Ceroplastes rusci*, L., *Aphis ficus*, Theo., and others, on the leaves; and the Cynipid, *Sycophaga sycomori*, L., on the fruit. Notes are given on the life-histories of the more important of these.

ALFIERI (A.). **Les insectes de la tombe de Toutankhamon.**—*Bull. Soc. R. ent. Egypte*, 1931, fasc. 3–4, pp. 188–189. Cairo, 1931.

Insects found in alabaster vases in the tomb of Tutankhamen were *Lasioderma serricorne*, F., *Sitodrepa panicea*, L., and the Ptinid, *Gibbium psylloides*, Czemp., generally embedded in some substance such as dried resin. These beetles are therefore probably indigenous to Egypt and have scarcely altered morphologically in the 3,500 years that have elapsed.

KANGAS (E.). **Siikakankaan mäntytaimistojen tuhoista.** [The Injuries to Pine Stands at Siikakangas.]—*Silva Fennica*, no. 17, reprint 107 pp., 12 figs., 1 map. Helsingfors, 1931. (With a Summary in German.)

A list of insects, in which Coleoptera predominate, is given from an area in Finland that was destroyed by fire in 1909 and re-planted, mostly in 1911–1916, with pines. The Chrysomelid, *Luperus pinicola*, Duft., is the most widespread pest, but it only occurs sporadically. In severely infested localities, which are often sharply defined, nearly all the pines are attacked. It usually destroys only the one-year-old needles; the larvae apparently live in the ground as the adults seem to oviposit there. This beetle is a primary pest that weakens the trees to such an extent as to render them susceptible to other enemies. The Curculionids, *Brachyderes incanus*, L., and *Hylobius abietis*, L., do little damage, but another weevil, *Pissodes notatus*, F., is a most injurious pest. The Tortricid, *Rhyacionia* (*Evetria*) *resinella*, L., is also very common and is next in importance. The sawfly, *Diprion* (*Lophyrus*) *pallipes*, Fall., occurs only in stands 5–10 years old, but it injures them severely as it eats only one-year-old needles.

DA COSTA LIMA (A.). *Amorbia catenana* **(Wlsm.), microlepidoptero que se desenvolve na banana (Tortricoidea : Sparganothidae).** [*A. catenana*, a Microlepidopteron developing in Banana.]—*Bol. biol.*, fasc. 18, pp. 39–44, 5 figs., 7 refs. Rio de Janeiro, October 1931.

The occurrence is recorded of the larva of *Amorbia catenana*, Wlsm., in a banana fruit, in Brazil, which it subsequently left in order to pupate. The original descriptions of both sexes are reproduced. This species, which may become a serious pest, also occurs in the Antilles and in Central and South America.

BONDAR (G.). **Uma nova praga das orchideas** (*Anaphothrips orchidearum* **Bondar) e como combater esta e outros thysanopteros damninhos.** [*A. orchidearum*, a new Pest of Orchids, and Measures against this and other injurious Thysanoptera.]—*Chacaras e Quintaes*, xliv, no. 4, pp. 435–436, 1 fig. S. Paulo, 15th October 1931.

Anaphothrips orchidearum, sp. n., is described from various orchids in Bahia. Other Thysanoptera attacking orchids in the State are

Heliothrips haemorrhoidalis, Bch., and another new species not yet described. Spraying with nicotine or lime-sulphur is the remedy advised, which is also suitable for *Cerataphis lataniae*, Boisd., common on orchids and palms.

Blunck (H.). **Der Massenwechsel der Insekten und seine Ursachen.** [The Variation in Insect Abundance and its Causes.]—*4. Wanderversammlung deuts. Ent. Kiel* (11.–15. vi. 1930), pp. 19–41, 4 pp. refs. Berlin, November 1930. [Recd. November 1931.]

This paper describes the methods that have been employed to solve the problem of variation in insect abundance, surveys the results obtained up to date, and indicates further possibilities in developing such investigations.

Tomaszewski (W.). **Zur Bekämpfung der Gallmücken, deren Larven in den Blüten von Gräsern schmarotzen.** [The Control of Gall-midges having Larvae infesting the Flowers of Grasses.]—*Nachr Bl. deuts. PflSchDienst*, xi, no. 11, pp. 89–91, 10 refs. Berlin, November 1931.

Cecidomyiids infesting the flowers of grasses in various parts of the world sometimes cause losses of 80–90 per cent. of the seed crop. Some species, such as *Dasyneura alopecuri*, Reut., pupate in the flowers and are therefore transported in seed, whereas others, such as *Contarinia merceri*, Barnes, do so in the ground. The former are fairly easy to control by heating or fumigating the seed or by storing it for over a year before sowing. The latter, however, are difficult to control. The species of *Contarinia* that seriously infests *Poa pratensis* and *P. trivialis* in Germany [*R.A.E.*, A, xviii, 662; xix, 587] also belongs to this group. Failure attended attempts to control it by catching the adults on adhesive surfaces or by manuring with kainit. The eggs and larvae in the flowers may be destroyed by advancing the date of mowing. Exact information on the value of this method was obtained by counts of the larvae in the panicles of *P. pratensis* three weeks after the beginning of emergence of the adults. It was found that the infestation was highest in fields that had for years been producing grass seed, and that early mowing, at the time the larvae are developing in the flowers, reduces it to an economic level. It is advisable not to grow grass for seed in the same meadows for more than five years, to mow early in the third, and to grow another crop before sowing grass again.

Goffart (H.). **Ueber Schadauftreten von** *Blaniulus guttulatus*. [On the harmful Occurrence of *B. guttulatus*.]—*Nachr Bl. deuts. PflSchDienst*, xi, no. 11, pp. 91–92. Berlin, November 1931.

During the past two years millepedes, chiefly *Blaniulus guttulatus*, Bosc, have occurred in numbers in various parts of Germany, injuring cabbages, turnips, beans, potatoes, lettuces, etc. An abundance of decomposing matter in the soil, heavy manuring, and unfavourable weather are among the causes that give rise to serious infestation. The pests are best controlled by repeatedly treating the soil with lime water, which is apparently most effective if powdered lime is applied once before sowing.

Feytaud (J.). **Les vers des tiges du maïs.**—*Rev. Zool. agric.*, xxix, no. 6, pp. 85–96, 1 pl., 3 figs., 19 refs. Bordeaux, June 1931. [Recd. December 1931.]

An account is given of the bionomics of the two principal pests of maize stalks in France, namely, *Pyrausta nubilalis*, Hb., and *Sesamia vuteria*, Stoll (*nonagrioides*, Lef.). Either one or two generations of the former occur annually, according to the season and the region ; there are two in the Mediterranean region, but only one in the northern maize-growing area. In the south-west there are nearly always two, unless weather conditions are very unfavourable. *S. vuteria* generally has two generations, the periods of damage being from May to July and again from August to October, the larvae of the latter generation remaining at the base of the stalks until the spring. The usual measures practised against *P. nubilalis* are recommended against both species.

Chevalier (A.). **Myriapodes ennemis des jeunes caféiers à la Côte d'Ivoire.**—*Rev. Bot. appl.*, xi, no. 123, p. 942. Paris, November 1931.

The Myriapods, *Ophistreptus rugosus*, Attems, and *Pachybolus laminatus*, Cook, var. *chevalieri*, Brölem., are recorded as damaging coffee on the Ivory Coast by cutting off the young seedlings at the ground level. They are particularly numerous during the second rainy season (October and November).

Schütze (K. T.). **Die Biologie der Kleinschmetterlinge unter besonderer Berücksichtigung ihrer Nährpflanzen und Erscheinungszeiten.** [The Biology of Microlepidoptera with particular Reference to their Food-plants and Dates of Appearance.]—Med. 8vo, 235 pp. Frankfurt am Main, Verlag Int. Ent. Vereins, 1931. Price *M.* 20.

This book constitutes a list of German Microlepidoptera arranged according to their food-plants. Brief notes are given on the biology of each species. There are two indices, one to the plants and the other to the insects.

Frappa (C.). **Les principaux insectes nuisibles aux plantes productrices de tanin à Madagascar.**—*Agron. colon.*, nos. 166–167, pp. 97–98, 129–135, 2 pls., 9 refs. Paris, October–November 1931.

Besides the native mangroves, which are exploited on parts of the coast of Madagascar for producing tannin, plantations of wattles have recently been made on the high plateaux, of which the most valuable is *Acacia decurrens*. These are attacked by various insects, the most important being the Cercopid, *Ptyelus goudoti*, Benn, the adult and immature stages of which are described. It also occurs on almond, apricot, peach, plum, *Eucalyptus*, *Albizzia*, and various other trees. There is apparently only one generation a year, the immature stages appearing in numbers on the branches about the end of September and sucking large quantities of sap from them. The adults appear from mid-December to late January and also extract the sap, some branches becoming so dried up that they wither and die. The Psychid, *Deborrea malgassa*, Heylaerts, another important pest of *Acacia* in Madagascar, attacks many other trees, including *Cupressus*, plums and almonds, as well as the undergrowth in *Acacia* plantations. The

life-cycle occupies a year. The larva, upon hatching, in late March or early April, emerges from the maternal case and feeds for 8 or 9 months under a cone-shaped shelter that it weaves of silk and débris. Before pupation it encloses the case in a firm cocoon of silk which it suspends from a branch. The larval cases should be collected.

Other pests include : *Plataspis variegata*, Guér., *P. coccinelloides*, Lap., and *P. coccinelloides* var. *madagascariensis*, Guér., which also occur on *Albizzia*, *Grevillea* and other trees ; an undetermined Coccid, which caused great damage in 1927–28 and which is parasitised by a recently described Eulophid, *Marietta marchali*, Mercet ; *Icerya seychellarum*, Westw., which has been taken on *Acacia heterophylla* ; the Coreid, *Anoplocnemis madagascariensis*, Sign., which infests the young shoots ; the Pierids, *Callidryas florella*, F., and *Xanthidia floricola*, Boisd.; the Noctuid, *Polydesma umbricola*, Boisd. ; the Cerambycid, *Phryneta marmorea*, Ol., living in the trunks of dying trees ; the Melolonthid, *Encya strigiscutata*, Fairm. ; and the Bostrychids, *Xylopertha picea*, Ol., *Xyloperthodes castaneipennis*, Fhr., and *Sinoxylon* sp. The Tenebrionid, *Derosphaerus globilicollis*, Thoms. (*globulicollis*, Fairm.) and a Buprestid of the genus *Diplolophotus*, have been recorded as damaging *Albizzia lebbek*.

The increase of these pests would be checked by alternating stands of different species of trees or even by establishing mixed stands instead of pure ones. Unhealthy trees should be removed from the plantations.

Henkel (J. S.). **Attacking the Bagworm with Salt.**—*The Natal Witness*, 24th December 1931, 3 cols. illus. Pietermaritzburg, 1931.

The author, late conservator of forests in Southern Rhodesia and previously conservator of forests in Natal, states, as the outcome of ecological studies and field and laboratory experiments, that common salt applied to the soil at the rate of 400–600 lb. to the acre appears to be an effective, reasonably cheap and safe method for combating *Acanthopsyche junodi*, Heyl., on wattle [*Acacia*]. The salt is taken up by the tree and causes the bagworm larva quickly to cease feeding and eventually to shrivel and die. The tree appears to be sufficiently tolerant of salt to admit of the treatment. A twig from a tree in untreated ground showed, on analysis, 1·434 per cent. of NaCl in its ash ; whereas a twig from a tree in soil treated eight weeks previously with salt at the rate of 600 lb. to the acre showed 13·56 per cent. Black wattle trees fully exposed to salt-laden ocean wind were observed to be free from the bagworm. Pending the accumulation of guiding experience, it is suggested that wattle-growers at first confine the use of the remedy to one- and two-year-old stands of the trees, applying 400–600 lb. to the acre and taking care to make the application as uniform as possible.

Hazelhoff (E. H.). **Entomologisch onderzoek.** [Entomological Investigation.]—*Jaarversl. Proefst. Java Suikerind. 1930*, pp. 89–92. Surabaya, 1931.

As in the preceding year [*R.A.E.*, A, xviii, 703] most of the work done by the Experiment Station was on the sugar-cane tip-borer, *Scirpophaga intacta*, Sn., the information given having already been

noticed [xviii, 194, 704; xix, 337]. The larvae of a species of *Spodoptera* severely injured maize and rice in several localities. The best method of checking its spread is to flood the channels surrounding the fields immediately they are observed.

VAN POETEREN (N.). **Bestuiving van dennenbosschen met behulp van motorverstuivers.** [The Dusting of Pinewoods by Means of Power Dusters.]—*Tijdschr. Plantenziekt.*, xxxvii, no. 10, pp. 200–200c, 2 pls. Wageningen, 1931.

This article describes the first use in Holland of power dusters. Two machines were tried, an arsenical preparation and a contact insecticide, both proprietary, being applied to pine woods against the sawfly, *Diprion* (*Lophyrus*) *pini*, L., and the weevil, *Brachyderes incanus*, L. Though such dusting may not prove economically possible in Holland, its advantage over dusting by aeroplane was amply demonstrated in the case of small woods.

OTANES (F. Q.). **Notes on Cane Grubs in Batangas and Occidental Negros. Collecting Beetles as a Control Measure.**—*Philipp. J. Agric.*, ii, no. 2, pp. 129–161, 3 pls., 4 figs., 13 refs. Manila, 1931.

The author dissents from the view of Uichanco [*R.A.E.*, A, xviii, 651] that hand collection of the adults as a measure against the Melolonthid, *Leucopholis irrorata*, Chevr., in the Philippines is of little value. It is considered that the reduction in the injury caused by the beetles in Batangas following the campaign of hand collecting during 1926–27 was entirely due to this method and was not influenced by biological factors, since no natural enemies of the adults or the larvae were observed, nor did any unfavourable climatic conditions occur. Moreover, large numbers of females were collected before they were able to oviposit, and the areas involved did not become reinfested, thus supporting the author's view that the adults, although strong fliers, do not migrate from one locality to another to any great extent.

Although there had been isolated efforts in Occidental Negros to control cane grubs by hand collection, no definite steps were taken to cope with the problem on an extensive scale until November 1929.

The largest number of beetles collected in one locality was 7 millions of *L. irrorata* and *Lepidiota* sp., during May, in addition to 7½ millions of smaller Lamellicorns. It is probable, however, that the total greatly exceeds the figures recorded, since large numbers of *Leucopholis* and *Lepidiota* were not handed in to be paid for, but were used by the workers as food. Of the individuals of *L. irrorata* examined by Uichanco [*cf. loc. cit.*; also xix, 575] a considerable number had been in captivity without food for some days, and it is known that starvation affects the production and the development of eggs. The average number of eggs per female obtained by one worker from samples collected during the height of the campaign (12th May 1930) were 22·79 in one locality and 22·96 in another for *Lepidiota* sp., probably *pruinosa*, Wied., and 19·64 for *Leucopholis irrorata*.

Measures preferable to those suggested by Uichanco are the encouragement of parasites of *L. irrorata*, of which the Scoliid, *Campsomeris aureicollis*, Lep., is the commonest, and the propagation of a plant that is attractive to it (*Stachytarpheta jamaicensis*) in waste lands and along the borders of cane fields. These wasps have also been

observed visiting *Leucas javanica*. The larvae of the beetles are also attacked by parasitic fungi, of which *Cordyceps podocreoides* is rather common in some localities.

Suzuki (B.). **Illustrations of the Japanese Mulberry Insects.** [*In Japanese.*]—xvi+122 pp., 20 pls. Tokyo, Maruyama-Sha Book Shop, 1930.

Brief descriptions are given of 149 species of insects injurious to mulberry in Japan, with illustrations.

Kawada (A.). **The Adult, Egg, Larva and Pupa of** *Nygmia piperita* **Obert.** [*In Japanese.*]—*Kontyû*, v, pp. 125–128, 1 pl., 1 fig. Tokyo, 1931.

Detailed descriptions are given of all stages of *Nygmia piperita*, Oberth., which has at least two generations a year in Japan. In captivity the larvae fed on the leaves of *Mallotus*.

Ishii (T.). **Notes on the phytophagous Habit of some Chalcidoids, with Descriptions of two new Species.**—*Kontyû*, v, pp. 132–138, 5 figs. Tokyo, 1931.

The species described are *Decatoma smilacis*, sp. n., from the seeds of *Smilax china*, and *Tetrastichus* (*Geniocerus*) *ardisiae*, sp. n., from the shoots of *Ardisia japonica* in Japan.

Kuribayashi (K.). **On** *Delphacodes striatella* **Fall., in Relation to the Transmission of a Virus Disease of the Rice Plant.** [*In Japanese.*] —*J. Plant Prot.*, xviii, no. 10, pp. 565–571. Tokyo, 1931.

Adults of *Delphacodes striatella*, Fall., that emerged in the middle of May from nymphs bred on a rice plant infected with a virus disease in the preceding year produced the disease in healthy plants, females showing greater ability for retaining the virus than males. Offspring of infected females and non-infected males produced the disease, but that of non-infected females and infected males showed negative results. Further experiments on these lines are, however, necessary.

Takano (S.). **On the Species and scientific Names of the Flies parasitic in the Silkworm in Japan.** [*In Japanese.*]—*Insect Wld.*, xxxv, pp. 254–260. Gifu, 1931.

Sturmia sericariae, Rond., *Tricholyga sorbillans*, Wied., *Tachina larvarum*, L., and *Pales pavida*, Mg., of which last *Gaedia ignavus*, Nishikawa, and *G. puellae*, Nishikawa, are considered to be synonyms, are recorded as parasites of the silkworm [*Bombyx mori*, L.] in Japan.

The Breeding of *Aulacophora similis* **Oliv.** [*In Japanese.*]—*Ann. Rep. Tainan Agric. Expt. Sta. 1929*, pp. 96–101. Tainan, Formosa, 1931.

Ceratia (*Aulacophora*) *similis*, Ol., has two and occasionally three generations a year in Formosa, hibernation taking place in the adult stage. From about February onwards, when the temperature reaches 22° C. [71·6° F.], the beetles, which live for about 200 days, feed on the

leaves and flowers of various curcubits and other vegetables, including radish. About 30 eggs are laid at a time, the female ovipositing 10–20 times. They hatch in 9–10 days in summer and in 23–26 days in winter. The larvae, which moult three times, feed on the roots of the food-plants, becoming mature in 20–36 days. The pupal stage lasts 7–14 days. Exposure to sunshine for about 30 minutes kills the eggs.

Kodama (G.). **Studies on** *Aleurocanthus spiniferus* **Quaint.** [*In Japanese.*]—38 pp., 6 pls. Kagoshima-Ken, Kyushu, Japan, 1931.

The whitefly, *Aleurocanthus spiniferus*, Quaint., which has been observed since 1919 in the most southerly part of Kyushu, is now widely distributed and very injurious to *Citrus* throughout this region. There are four generations a year, hibernation taking place in the last larval stage and the adults appearing from the middle of April. The eggs are laid on the lower surface of the leaves, particularly the young ones, about a day after the emergence of the adults. An average of 17–22 eggs, but occasionally as many as 55, are produced, unfertilised ones giving rise only to males. They hatch in 11–27 days; in an experiment 64–96 per cent. hatched. The larval stage lasts from 3 to over 12 weeks and the pupal one from 12 to over 60 days, shorter time being required in summer. A Platygasterid, *Amitus* sp., kills 12–27 per cent. of the pupae, and a Coccinellid, *Delphastus* sp., feeds on them, but is not important. Sprays containing sodium sulphate and soap, lubricating oil, or resin are recommended for control.

Noguchi (T.). **On the Life-history of** *Rhizoecus kondonis* **Kuw.** [*In Japanese.*]—*J. Plant Prot.*, xviii, pp. 640–644, 2 figs. Tokyo, 1931.

The Coccid, *Rhizoecus kondonis*, Kuw., which attacks the rootlets of *Citrus*, is distributed throughout Honshu and Shikoku and is very injurious. It has 3 generations a year, hibernation taking place in the adult stage. The ovisacs are formed in May, July and September, one female laying about 125 eggs.

Kuwana (I.). **On the Coccids occurring in Citrus Gardens in China.** [*In Japanese.*]—*Engei-no-Kenkyu*, no. 27, reprint 10 pp., 1 pl. Okitsu, Japan, 1931.

Brief notes are given of 25 species of Coccids occurring on *Citrus* in China, of which *Parlatoria zizyphus*, Lucas, is the commonest. The original habitat of *Prontaspis yanonensis*, Kuw., which is very destructive in Japan, is thought to be Central China.

Kono (Y.). **The Effect of Light Traps on the Sites for Oviposition of** *Chilo simplex*, **Butl., and the Rate of Parasitism in the Eggs.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iii, pp. 276–279. Tokyo, 1931.

Experiments in Japan showed that in fields where light traps are used the eggs of *Chilo simplex*, Butl., are laid on the upper leaves of rice and are thus more exposed to Hymenopterous parasites than in unlighted fields, the rate of parasitism being consequently increased.

TANABE (C.) & SEKIYA (I.). **On the Biology of** *Epilachna niponica* **Lew.** [*In Japanese.*]—*Rep. Nagano Agric. Expt. Sta.*, no. 2, pp. 1–15. Nagano, Japan, 1931.

Epilachna niponica, Lew., is very injurious to potato in Japan, serious damage being done from the end of June to the time the crops are harvested. It also attacks tomato and egg-plant, but to a less degree, only a few eggs being laid on tomato and hardly any on egg-plant. The larval development is also retarded on these plants, especially on the latter. Where there are two crops of potatoes, in spring and again in autumn, there are two generations a year. The adults hibernate in masses under fallen leaves or in other sheltered places that are moist and warm. They become active about the middle of April and begin feeding at the end of the month. Oviposition takes place from the middle of May, and the overwintered adults die in August. Females produce an average of 284 eggs in the course of 34 days, but have been known to lay over 500 in captivity. In May the egg, larval and pupal stages last about 10, 24 and 6 days respectively, and in August 4, 14 and 5.

TANABE (C.) & SEKIYA (I.). **Studies on** *Diplosis mori* **Yokoy.** [*In Japanese.*]—*Rep. Nagano Agric. Expt. Sta.*, no. 2, pp. 17–43, 2 pls. Nagano, Japan, 1931.

Much of this information on the Cecidomyiid, *Diplosis mori*, Yokoyama, which is very injurious to the buds of mulberry throughout Japan and Korea, has been noticed from a briefer account [*R.A.E.*, A, xix, 261]. Natural enemies include a Proctotrupid, which has two generations a year. Of a number of insecticides tested for controlling the larvae underground, lime-sulphur solution (specific gravity 3–5°) and mercurous chloride (1 : 3,000–4,000) are recommended.

MATSUSHITA (M.). **On a new Subspecies and an unrecorded Species of Cerambycidae injurious to Trees.** [In Japanese, with description of a new subspecies in German.]—*Insect Wld.*, xxxv, pp. 376–378. Gifu, 1931.

Descriptions are given of the Lamiids, *Pogonochaerus fasciculatus*, DeG., subsp. *pullus*, n., occurring on spruce (*Picea*), and *Acanthoderes clavipes*, Schr., on *Populus*, in Japan.

ARAKAWA (Y.). **On the Food-plants of** *Anomala pubicollis* **Waterh.** [*In Japanese.*]—*Insect Wld.*, xxxv, pp. 411–413. Gifu, 1931.

A list is given of 24 trees injured by *Anomala pubicollis*, Waterh., in May and early June in Manchuria.

SONAN (J.). **Notes on** *Biston marginata* **Shiraki, a Pest of the Tea Plant, and on Methods of controlling it.** [*In Japanese.*]—*Bull. Dept. Agric. Govt. Res. Inst. Formosa*, no. 86, pp. 23–29, 1 pl. Taihoku, Formosa, 1931.

The Geometrid, *Biston marginata*, Mats., occurred in large numbers in May 1930 near Taihoku, Formosa, defoliating tea. Outbreaks seem to take place at intervals of about 15 years, and last about 4. It also feeds on *Acacia confusa* and other plants.

Commun (R.). **Etudes de la Division de Phytopathologie . . . 1930.**— *Bull. écon. Indochine,* xxxiv, pp. 771B–779B. Hanoi, September 1931.

Rhynchota recorded on cotton in Indo-China during 1930 include two species of *Dysdercus,* possibly *Dysdercus cingulatus,* F., and *D. olivaceus,* F., and two of *Oxycarenus,* probably *O. bicolor,* Fieb., and *O. gossypii,* Horv., of which brief descriptions are given, the former from Cambodia and the latter from South Annam. Lepidoptera included *Pyroderces simplex,* Wlsm., and *Platyedra* (*Pectinophora*) *gossypiella,* Saund., which has not before been recorded from Indo-China, and which attacked cotton in Cambodia. Descriptions are given of the larvae and adults, with notes on its biology and control. The Cicindelid, *Neocollyris crassicornis,* Dej., constructed galleries in the wood of coffee. As the larvae are probably predacious [*cf. R.A.E.*, A, xvii, 650], they may be of some benefit unless their galleries are sufficiently numerous to weaken the tree, in which case infested branches should be cut off and burnt, or, if they are very numerous, the larvae should be killed by inserting a wire into the galleries or by pushing vegetable fibres soaked in tar into the entrance holes and then closing the openings. Stored flour at Saigon was found to be infested by *Tribolium castaneum,* Hbst. (*ferrugineum,* F.) ; the measures recommended against it are thorough cleaning of the storehouses with some disinfectant and fumigation with sulphur dioxide or carbon tetrachloride, details of these processes being given. The larva of a Geometrid, which is described, attacked the leaves of potato in South Annam. A spray containing 7½ lb. of a proprietary calcium arsenate paste and 5 lb. slaked lime in 100 gals. water is recommended against it.

Ladell (W. R. S.). **Carpenter Bees eating Lead Cable-covers.**— *J. Siam Soc.,* Nat. Hist. Suppl., viii, no. 3, pp. 213–214. Bangkok, 25th September 1931.

In June 1928 and again in April 1930, damage to lead cable-covers in Siam suggested attack by carpenter bees (*Xylocopa* spp.). In experiments with *X. latipes,* F., bees confined in a section of lead pipe, with closed ends and small holes for admitting daylight and drops of sugar-water for food, bored their way out, making holes similar to those made on the cable. Remedial measures suggested are armouring the cable with brass or coating it with a mixture of tar and sand.

Kunhi Kannan (K.). **Report of the Work of the Entomological Section during the Year 1929–30.**—*Ann. Rep. Agric. Dept. Mysore 1929–30,* pp. 25–29. [Bangalore, 1931.]

An unusually severe outbreak of *Cirphis unipuncta,* Haw., the most serious on record, occurred in a number of localities in Mysore during 1929, the extent of the damage being correlated with the date of planting of the crops and varying from 25 to 75 per cent. The absence of early rains, which delayed the planting by 4–6 weeks, was the most important factor responsible for the outbreak. This probably enabled the young larvae of the second generation to develop successfully, owing to the abundance of tender leaves that are usually lacking during the advanced stages of growth of the plants. The larvae of a small

unidentified beetle were found attacking the roots of betel vine [*Piper betle*] and killing the plants. Carbon bisulphide, applied in teaspoonfuls in holes 4 ins. deep and 9 ins. apart proved effective ; the cost to the acre, using 22 lb., would be about 14*s.* 8*d.* Paradichlorobenzene was also effective, but is much more expensive. The treatment of pieces of wood with varnishes to which the alcoholic extract of the powdered bark of *Mundulea suberosa* [*cf. R.A.E.*, A, xix, 164] had been added rendered them fairly immune from the attacks of termites.

Massey (R. E.) & Andrews (F. W.). **The Leaf Curl Disease of Cotton in the Sudan. A Preliminary Note.**—*Emp. Cott. Gr. Rev.*, ix, no. 1, pp. 32–45, 6 pls., 2 graphs, 1 diag., 4 refs. London, January 1932.

This paper appears to have been written before a more extensive work on the subject [*R.A.E.*, A, xix, 708]. The following is taken from the authors' summary :—The distribution of "leaf-curl" of cotton in the Sudan is indicated, and the symptoms of the disease, both external and internal, are described. Its vector appears to be an Aleurodid, and transmission was not obtained by inoculation with the juice of infected plants. Experiments with grafting, which seems to be the only successful method of artificial transmission of the disease, are described. The question of transmission through the seed, the influence of manures on the incidence of the disease, and the effect of the latter on the yield of the crop are discussed. Chemical analyses of diseased and healthy cotton plants are recorded.

Anderson (T. J.). **Annual Report of the Senior Entomologist, 1930.**—*Ann. Rep. Dept. Agric. Kenya 1930*, pp. 190–205. Nairobi, 1931.

Notes are given by various authors on insect pests observed in Kenya during 1930, some of which have already been recorded [*R.A.E.*, A, xviii, 337 ; xix, 230]. R. H. Le Pelley reports that in one district, with only one exception, very severe attacks of the mealybug [*Pseudococcus lilacinus*, Ckll.] on coffee only developed when it was attended by the ant, *Pheidole punctulata*, Mayr. In such instances banding [*cf.* xviii, 566] should always be applied. No other ant, with the exception of *Acantholepis capensis*, Mayr, has been found associated with serious attacks of this mealybug. It is now certain that spraying is ineffective in preventing an outbreak of *P. lilacinus*, once this has begun to develop ; in certain cases, however, spraying may be of value in conjunction with other control measures. A Capsid observed during the current and previous years, preying upon the mealybug, has been identified as *Deraeocoris fulleborni*, Popp. In the course of laboratory breeding of other predators of *P. lilacinus* [*cf.* xix, 231], it was found that in 10 weeks, 400 individuals of *Cryptolaemus montrouzieri*, Muls., had increased to 17,000, as compared with 2,800 in the case of *Chilocorus angolensis*, Crotch, a native species. On an average, 1,700 potato-sprouting trays and 11 tons of potatoes were used for breeding mealybugs for *Cryptolaemus* to feed on, and a total of 100,000 individuals of this Coccinellid were liberated during the year.

Investigations show that in cases of blackening of coffee blossoms and their failure to set, associated with infestations of *Lygus simonyi*,

Reut. [*cf.* xviii, 440], the number of bugs present and the extent of the injury were nearly always directly proportionate to each other, and in the laboratory, the feeding of the bugs on the young flower spikes caused the typical form of flower-bud abortion noticed in the field. Apart from another undetermined factor, this Capsid may be considered the principal cause of this condition in the plants. It is widely distributed throughout the coffee-growing districts and has always caused serious damage on some estates. Investigations indicate that some of the failures to obtain uniform control of *Antestia*, a serious pest of coffee, following the application of a bait-spray, were due to the poisoning of its Hymenopterous egg parasites, parasitism by which sometimes amounts to as much as 90 per cent. A survey of one tree thus treated showed that 1,350 insects had been poisoned of which 100 were Hymenopterous parasites, some of which are known to attack *Antestia*, *Thliptoceras octoguttale*, Feld., and certain scale insects. In the laboratory, egg parasites of *Antestia* were readily attracted to the bait and were killed by it in a very short time. These observations may help to decide at what time spraying should be carried out, and when hand-picking should be substituted. *Thliptoceras octoguttale* and *Deudoryx lorisona*, Hew., were more than usually abundant, and in one plot were responsible for the loss of one-quarter of the coffee crop. Elsewhere in the Colony the former has been a definite pest rather than a beneficial crop-thinning agent as sometimes been previously supposed.

H. Wilkinson, in discussing his investigations on *Busseola fusca*, Fuller, on maize, states that from October 1929 to July 1930, inclusive, after which date planting was prohibited by regulation, maize was planted during each month with the result that the pest was provided with sufficient food for its continuous existence. Crops planted between October 1929 and February 1930 were few, and in these the borers concentrated, with the result that over 70 per cent. of the stalks became infested, and on an average 6 larvae or pupae were found to each stalk. Self-sown maize is a serious menace to the main crop, and as soon as possible after harvest, all maize stalks should be burned or turned into manure, and all self-sown maize destroyed. Maize should only be planted at such times between 15th February and 31st May, according to elevation, as will allow a period of at least 3 weeks to elapse between the destruction of all maize stalks and the beginning of planting of the following season's crop. For the control of this pest by top-dressing with derrisol, a concentration of 1 part to 600 of water was found to be necessary. This measure is only recommended in certain cases on small plots, when it may be essential that the crop be saved owing to its value for experimental purposes.

Investigations on the damage caused to stored maize by *Calandra oryzae*, L., showed 19·2 per cent. of a total of 75,500 bags of maize inspected on 21 estates to be heavily infested, 87 per cent. being determined as wet. Every case of heavy infestation was found to have originated in the field, and showed the most favourable conditions for the development of the weevils, the temperature in the maize between 8 a.m. and 4 p.m. being 68° F., and its moisture content usually between 12 and 14 per cent. Experiments with carbon bisulphide showed that fumigation is only of value in an airtight chamber. Fresh maize should not be stored near grain known to be infested, and before storing the new crop, the cribs should be thoroughly cleaned with a disinfectant. The ground beneath the cribs should

also be rendered unsuitable for breeding purposes by placing a two-inch layer of lime containing 5–10 per cent. of naphthalene or para-dichlorobenzene.

Other pests included *Metadrepana andersoni*, Tams, on coffee, Elaterids, which destroyed about 20 acres of maize on land previously sown to oats, and *Phytometra chalcites*, F., infesting the stems of edible canna [*Canna edulis*].

WILKINSON (D. S.). **Some new Species of** *Chelonella* **(Hym. Brac.).**—*Stylops*, i, pt. 1, pp. 6–10, 2 figs. London, 15th January 1932.

Among the species described is *Chelonella versatilis*, sp. n., a male of which was reared from *Heliothis obsoleta*, F., and females from the pink bollworm [*Platyedra gossypiella*, Saund.], in the Anglo-Egyptian Sudan. This species has previously been erroneously identified as *C. curvimaculata*, Cam. [*R.A.E.*, A, xix, 391]. The latter is recorded from *Phthorimaea* on potato and tobacco in Mauritius.

DELMAS (R.). **Le doryphore de la pomme de terre.**—*Prog. agric. vitic.*, xcvi, no. 51, pp. 591–597, 1 pl. Montpellier, 20th December 1931.

An account is given of the history of introductions of the Colorado potato beetle, *Leptinotarsa decemlineata*, Say, into Europe from America, and, in particular, of its occurrence in France since 1922 and of the measures that have been used to combat it. The organisation of the Plant Protection Service in the different infested zones and the introduction of parasites from America are described.

CHRYSTAL (R. N.). **An Oecophorid Moth,** *Borkhausenia pseudospretella* **Stainton, attacking Book Bindings.**—*Ent. Mon. Mag.*, lxviii, no. 812, pp. 9–10, 1 pl. London, January 1932.

An account is given of the damage caused to books stored in a cellar in Oxford by *Borkhausenia pseudospretella*, Staint. About 40 per cent. of the books were attacked, and in about 15 per cent. of these considerable damage had been done to the bindings, cloth bindings being invariably preferred; only in 4 books of 1,600 examined were traces found of boring in the pages. The caterpillars were lying in rough cocoons on the shelves, crawling about between the books, and in a few cases in the act of chewing irregular tunnels on the outer bindings. Some became mature in March and constructed cocoons of silk mingled with fragments of the binding in the groove between the cover and fly-leaf. This shelter is evidently chosen on account of the free exit afforded for emergence. The moth was bred out in August. It has been recorded as very common in houses and often found feeding on seeds, dried plants, insects, etc. It appears to have taken the place of the clothes moths in England and is causing much damage in furniture depositories in London. The moths occur from May to September, and the larval period extends from June to April of the following year.

The infestation was apparently successfully controlled by fumigation with formalin candles, which did not injure the books.

PAPERS NOTICED BY TITLE ONLY.

YUKAWA (H.). **On the Food-plants of** *Antheraea pernyi*, **Guér.** [in Manchuria]. [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iii, pp. 279–285. Tokyo, 1931.

KONO (T.). **A List of injurious Insects of "Sakura" (Cherry Tree)** [130 species with Japanese references]. [*In Japanese.*]—*Insect Wld.*, xxxv, pp. 233–238, 270–275, 309–311, 335–339, 382–384, 414–416. Gifu, 1931.

FUKUOKA AGRIC. EXPT. STA. **Fungus and Insect Pests of Fruit Trees and Methods for their Control** [including a brief account of 30 important insect pests]. [*In Japanese.*]—68 pp., 5 pls. Izumi-Mura, Fukuoka, Japan, 1931.

FUKUOKA AGRIC. EXPT. STA. **Fungus and Insect Pests of Vegetables and Methods for their Control** [including 12 important insect pests]. [*In Japanese.*]—40 pp., 5 pls. Izumi-Mura, Fukuoka, Japan, 1931.

FROGGATT (W. W.). **A Classification of the Gall-making Coccids of the Genus** *Apiomorpha*.—*Proc. Linn. Soc. N.S.W.*, lvi, pt. 5, pp. 431–454, 30 figs. Sydney, 15th December 1931.

BIBBY (F. F.). **Coccoids collected on wild Plants in semi-arid Regions of Texas and Mexico (Homoptera).**—*J. N. Y. Ent. Soc.*, xxxix, no. 4, pp. 587–591, 9 refs. New York, December 1931. [See *R.A.E.*, A, xx, 56.]

MISRA (A. B.). **On the internal Anatomy of the male Lac Insect,** *Laccifer lacca*, **Kerr (Homoptera, Coccidae).**—*Proc. Zool. Soc. Lond.*, 1931, pt. 4, pp. 1359–1381, 11 figs., 18 refs. London, December 1931.

HILLE RIS LAMBERS (D.). **A List of the Aphididae of Venezia Tridentina. Parts I & II.**—*Mem. Mus. Stor. nat. Venezia tridentina*, i, fasc. 1–2, pp. 25–28, 39–43. Trento, 1931.

SEIDEL (J.). **Blattminierer der Oberglogauer Gegend.** [Leaf-miners of the Oberglogau District, Silesia.]—*Beuthener Abh. oberschles. Heimatforsch.*, no. 4–5, 50 pp., 1 pl., 2 pp. refs. Beuthen, 1931.

JOY (N. H.). **A practical Handbook of British Beetles.**—Roy. 8vo, 2 vols., xxvii + 622 pp., & 194 pp., 170 pls. London, H. F. & G. Witherby, 1932. Price, 63*s*.

BÖVING (A. G.) & CRAIGHEAD (F. C.). **An illustrated Synopsis of the principal larval Forms of the Order Coleoptera.**—*Ent. Amer.*, xi, nos. 1–4, pp. 1–351, 125 pls. Brooklyn, N.Y., 1931.

MURAYAMA (J.). **Supplementary Notes on the Platypodidae of Formosa III.**—*J. Fac. Agric. Hokkaido Imp. Univ.*, xxx, pt. 4, pp. 195–203. Sapporo, December 1931. [*Cf. R.A.E.*, A, xvii, 56.]

TRÄGÅRDH (I.). **Studien über die Gänge der Borkenkäfer.** [Studies on the Galleries of the Bark-beetles.]—*Verh. deuts. Ges. angew. Ent., 8. Mitgliederversamml. Rostock Aug. 1930*, pp. 54–64, 10 figs. Berlin, 1931. [Translation of paper already noticed, *R.A.E.*, A, xix, 173.]

SAALAS (U.). **Ueber die Verbreitung der Borkenkäfer (Ipidae) in Finnland. Mit besonderer Berücksichtigung ihres Vorkommens in den nördlichen Waldgrenzen.** [On the Distribution of Bark-beetles (SCOLYTIDAE) in Finland. With special Reference to their Occurrence in the northern Limits of Forest.]—*Verh. deuts. Ges. angew. Ent., 8. Mitgliederversamml. Rostock Aug. 1930*, pp. 65–71, 3 maps, 6 refs. Berlin, 1931.

PFEFFER (A.). **Zoogeographische Verbreitung der Borkenkäfer in der Tschechoslowakischen Republik.** [Zoogeographical Distribution of Bark-beetles in the Czechoslovakian Republic.]—*Verh. deuts. Ges. angew. Ent., 8. Mitgliederversamml. Rostock Aug. 1930*, pp. 72–76. Berlin, 1931.

[STARK (V. N.).] **Старк (В. Н.). Bark-beetles of the Forests in Khibinui, Lapland.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, pp. 19–28, 1 diag. Leningrad, 1931.

[ZAKHAROV (L. Z.).] **Захаров (Л. З.). Mown Strips and Baits against the Migratory Locust** [*Locusta migratoria*, L.] **in Reed Swamps.** [*In Russian.*]—*Plant Protection*, viii, no. 2, pp. 167–170, 1 ref. Leningrad, 1931. [*Cf. R.A.E.*, A, xix, 563.]

SWAINE (J. M.). **Airplane Dusting for the Control of Forest Insects in Canada.**—*Canad. Woodlands Rev.*, March 1930, p. 28 (reprint 4 pp.), 4 figs. *Sine loco*, 1930. [*Cf. R.A.E.*, A, xviii, 285; xix, 218, in which the cost of dusting was erroneously given as £1 16*s.* to the acre instead of £1 4*s.*]

LEFEBVRE (C. L.). **Preliminary Observations on two Species of** *Beauveria* [*B. bassiana* and *B. globulifera*] **attacking the Corn Borer,** *Pyrausta nubilalis* **Hübner.**—*Phytopathology*, xxi, no. 12, pp. 1115–1128, 4 figs., 10 refs. Lancaster, Pa., December 1931. [*Cf. R.A.E.*, A, xix, 266.]

HILLE RIS LAMBERS (D.). **Gegevens over levenswijze en bestrijding der bietenvlieg** (*Pegomyia hyoscyami*, **Pz.**) **uit de litteratuur.** [Data on the Biology and Control of the Beet Fly, *P. hyoscyami*, from the Literature.]—*Meded. Inst. Suikerbietenteelt*, i, no. 4, pp. 105–128. Bergen op Zoom, July 1931.

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OZOLS (E.). **Material zur Ichneumonidenfauna Lettlands. I.**—*Folia zool. hydrobiol.*, iii, no. 2, pp. 175–191, 5 figs. Riga, 23rd December 1931.

WILKINSON (D. S.). **On the Indo-Australian and Ethiopian Species of the Braconid Genus** *Spathius* **(Hymenoptera)** [including *S. bisignatus*, Wlk. (*dinoderi*, Gah.) *R.A.E.*, A, xiii, 432].—*Trans. Ent. Soc. Lond.*, lxxix, pt. 3, pp. 505–530, 1 pl., 12 figs. London, 31st December 1931.

MURR (L.) (née DANIELCZICK). **Ueber den Geruchsinn der Mehlmottenschlupfwespe** *Habrobracon juglandis* **Ashmead. Zugleich Beitrag zum Orientierungsproblem.** [On the Sense of Smell of *Microbracon hebetor*, Say (*H. juglandis*, Ashm.). A Contribution to the Problem of Orientation.]—*Z. vergl. Physiol.*, xi, pp. 210–270, 14 figs. Berlin, 1930.

THORPE (W. H.). **Experiments upon Respiration in the Larvae of certain parasitic Hymenoptera.**—*Proc. Roy. Soc.*, (B) cix, no. B 764, pp. 450–471, 16 figs., 22 refs. London, 2nd January 1932.

REINHARD (H. J.). **Revision of the American parasitic Flies belonging to the Genus** *Winthemia*.—*Proc. U.S. Nat. Mus.*, lxxix, art. 20, no. 2886, 54 pp., 1 pl. Washington, D.C., 1931.

UVAROV (E. B.). **The Ash Content of Insects.**—*Bull. Ent. Res.*, xxii, pt. 4, pp. 453–457, 14 refs. London, December 1931.

GINSBURG (J. M.). **Studies on Penetration of Oils into Plant Tissue.**—*Rep. New Jersey Agric. Expt. Sta. 1929–30*, pp. 163–167. New Brunswick, N. J., 1931. [*Cf. R.A.E.*, A, xix, 359; xx, 58.]

YOUNGKEN (H. W.). **A pharmacognostical Study of Derris.**—*Amer. J. Pharm.*, ciii, no. 11, pp. 628–637, illus. Philadelphia, Pa., November 1931.

Fisher (R. C.). **Notes on the Biology of the Large Elm Bark-beetle, *Scolytus destructor* Ol.**—*Forestry*, v, no. 2, pp. 120–131, 1 pl., 14 refs. London, December 1931.

A detailed account is given of the bionomics of *Scolytus scolytus*, F. (*destructor*, Ol.) [*cf. R.A.E.*, A, xvi, 586], in view of the fact that it may play an important part in facilitating the spread of Dutch elm disease [xviii, 177], which now occurs throughout the southern counties of England. The types of mines made in elms for maturation feeding and oviposition are described. Maturation feeding continues for 1–3 weeks or more, according to climatic conditions and to the numbers of Nematodes occurring in the reproductive organs, development of which is delayed by them [*cf.* xix, 299]. The number of eggs, which hatch in 11–14 days, varies with the length of the oviposition tunnel, one of average length (slightly over 4 cm.) containing 80–100. The larval tunnels vary in length from 6 to 9 cm. In many cases the pupal period, which lasts about 10–13 days, is passed under the surface of the bark, and in others, especially in logs with thin bark, it is passed in the sapwood. In many species of bark-beetle, after egg-laying has been in progress for some time, the adults migrate to fresh feeding grounds prior to a second egg-laying period. Observations indicate, however, that *S. scolytus* oviposits throughout the summer, the females deriving the necessary nutriment during the excavation of the egg-tunnels. The oviposition period of one female appears to last 5–10 weeks.

Adults emerge throughout the spring and summer (April–July) and oviposit during this period. Many of the larvae hatching from these eggs give rise to adults that emerge towards the end of July and during August. These adults oviposit in August, the resulting larvae hibernating and giving rise to adults the following spring. The remaining larvae from the original eggs do not pupate until the following spring, and the adults emerge with those of the second generation. There is marked overlapping of the broods and generations, and the life-history of the species must be modified according to the conditions prevailing in the infested locality. The length of the stages and the times of emergence will also vary from year to year.

Suire (J.). **Contribution à l'étude de *Braula coeca* Nitzsch.**—*Rev. Zool. agric.*, xxx, nos. 6–7, pp. 85–89, 101–114, 4 figs., 38 refs. Bordeaux, June–July 1931. [Recd. December 1931.]

An account is given of the biology of the bee-louse, *Braula coeca*, Nitz., based on the literature [*R.A.E.*, A, xiii, 240; xix, 320, etc.] and the author's observations in France. Eggs appear to be laid at random; they were often found to be deposited on brood cells, or on cells containing food. In the former case the larvae enter the cells and live on the food brought to the brood by the bees, in the latter case they migrate by tunnelling through the covers of the cells. Development requires an average of 20 days, so that when the parasite inhabits a drone cell it emerges before the host. Pupation may occur in covered cells or outside, and after a few days, emergence and pairing take place. Measures against this fly are reviewed from the literature.

(23270) Wt P2/3550 1,700 3/32 H & Sp Gp 52

Hille Ris Lambers (D.). **Notes on the Aphididae of Venezia Tridentina, with Descriptions of new Species. Parts I and II.**—*Mem. Mus. Stor. nat. Venezia tridentina*, i, fasc. 1–2, pp. 15–24, 4 pls.; pp. 29–38, 3 pls., 13 refs. Trento, 1931.

A re-description is given of *Aphis malvae*, Koch, with characters distinguishing it from *A. gossypii*, Glov., of which it has been considered a synonym. Among the other species dealt with is *Chaitophorus anuraphoides*, sp. n., found feeding on the bark of young twigs of *Salix viminalis* in the Trentino. *Submacrosiphum*, gen. n., is erected for *Macrosiphum hieracii*, Kalt.

Flanders (S. E.). **The Temperature Relationships of *Trichogramma minutum* as a Basis for racial Segregation.**—*Hilgardia*, v, no. 12, pp. 395–406, 4 figs., 9 refs. Berkeley, Cal. Agric. Expt. Sta., March 1931.

The following is the author's summary:—There are at least four races of *Trichogramma minutum*, Riley, that can be differentiated by colour when reared at identical temperatures. At certain dissimilar temperatures, however, they are indistinguishable one from the other.

A yellow race from Massachusetts is less responsive to variations in temperature, has a shorter life-cycle and develops in a normal manner at a higher temperature than the dark race from tropical Mexico. The relative differences between the life-cycle sub-races is constant for certain temperatures, but the differences may vary either directly or indirectly with the temperature. The amount of pigmentation in the adult is determined by exposure to low temperatures during the early pupal period. The slowing up of development by exposures to low temperatures is most marked in the pupal stage. The prepupal and late pupal periods are least affected by freezing temperatures. Variations in temperatures between 59 and 77° F. do not produce an acceleration or lagging in the primary reaction of developmental processes to different temperatures.

Lesley (J. W.). **The Resistance of Varieties and new Dwarf Races of Tomato to Curly Top (Western Yellow Blight or Yellows).**—*Hilgardia*, vi, no. 2, pp. 27–44, 11 refs. Berkeley, Cal. Agric. Expt. Sta., August 1931.

The following is taken from the author's summary of observations in California:—Some varieties of tomatos of dwarf habit, as well as one variety of standard habit proved to be resistant to curly top when exposed to natural infestation by *Eutettix tenella*, Baker. The resistance is weak, and seems to be due not so much to tolerance of the virus as to tendency to escape infection. In artificial infestation the chance of infection is influenced by the numbers of leafhoppers used. The incubation period of the disease after artificial infestation of plants not less than 3 weeks after transplanting varied from 2 to at least 7 weeks. No significant difference was found in the length of the incubation period or in the frequency of recovery in resistant and susceptible varieties, and resistance was not increased in plants that had recovered or in their progeny.

Cook (W. C.). **Notes on predicting the probable future Distribution of introduced Insects.**—*Ecology*, xii, no. 2, pp. 245–247, 4 refs. Brooklyn, N.Y., April 1931.

This paper discusses the technique used by the author in studies on the effect of climate on insects with a view to predicting the limits of their distribution in an area into which they may be introduced and the places in which they will cause greatest damage. The principle is that of comparison of environments, and the methods evolved, which require care in the interpretation of findings, are as follows :—The collection of data on the distribution of the insect in its present habitats, and the severity of infestation in them ; the sorting of these data into categories representing roughly 3 degrees of damage, corresponding to the 3 zones of distribution [*R.A.E.*, A, xvii, 550] ; the collection and plotting of climatic data from all of these habitats, both retaining the original data and combining them to form average charts for the 3 degrees of severity ; the careful study of charts to determine the limiting climatic factors, which are not always evident, though in most cases the average data for the 3 zones of abundance will indicate them ; the collection and study of any physiological data that are available, in order to check the findings of the climatic study ; the comparison of the favourable and unfavourable climates in the present distribution of the insect with the climate of the new area under consideration ; and the preparation of a map showing these climates in the new area and predicting the probable future distribution and relative severity of infestation.

The degree of success obtained in two earlier attempts to predict the distribution of injurious insects is pointed out. In 1924 the author outlined the regions in the United States in which outbreaks of the pale western cutworm [*Porosagrotis orthogonia*, Morr.] might be expected [xii, 164], and since then the additional outbreaks that have occurred have taken place in areas that were included in the economic distribution on the original map. A similar paper in 1925 [xiii, 432] on the alfalfa weevil [*Hypera variabilis*, Hbst.] attempted to predict the future economic distribution, and up to the present time only one or two small colonies have been found outside the areas outlined, no commercial damage being done, and in several instances the weevil has spread to the boundaries indicated on the map and has not crossed them.

The method will not give the absolute distribution of an insect, but it will show the economic distribution with considerable accuracy. Once the reliability of such a study is established, it may be based on insects just gaining a foothold, as a basis for intelligent quarantines that will not hinder commerce between an infested area and those regions where no damage is expected.

Gjullin (C. M.). **Probable Distribution of the Mediterranean Fruit Fly (*Ceratitis capitata* Wied.) in the United States.**—*Ecology*, xii, no. 2, pp. 248–258, 13 figs., 13 refs. Brooklyn, N.Y., April 1931.

The more important available data on the effect of temperature, rainfall and humidity on the life-history of *Ceratitis capitata*, Wied., are given, together with the results of a climatological study of all known occurrences of this fly in different parts of the world, made to determine the optimum and limiting conditions. From the latter the limiting

factors appear to be a mean temperature of less than 35° F. for 3 months of the year, combined with not less than 2 ins. of precipitation a month. A large amount of rainfall during the winter is equivalent in effect to lower temperatures. Favourable conditions are temperatures between 70 and 80° F. with a monthly rainfall of 3–7 ins. In the United States severe infestations might be expected in southern Florida and southern Texas [*cf. R.A.E.*, A, xx, 33]. The zones of normal, occasional and possible abundance have been defined by Cook [xvii, 550]. The limits of the zone of normal abundance are a mean monthly temperature of not less than 60° F. in combination with heavy rainfall during December, January and February, and a mean monthly temperature of not less than 55° F. in areas where precipitation for these months does not exceed 5 ins. The limits of the zone of occasional abundance are a mean monthly temperature of not less than 37° F. in combination with rainfall that does not exceed 5 ins. in December, January and February. In regions having over 5 ins. of rainfall the temperature varies upward, in proportion, to 42° F. Limits of the zone of possible abundance are a mean monthly temperature varying from 30 to 35° F. in proportion to the precipitation during the months of December, January and February. Areas with a mean monthly temperature of 30° F. have less than 5 ins. of precipitation during these months.

The sequence of host fruits is an important factor in determining the abundance of the fruit-fly. There is little doubt that this factor may cause a wide variation in its population within the zones as outlined.

SWEETMAN (H. L.). **Preliminary Report on the physical Ecology of certain *Phyllophaga* (Scarabaeidae, Coleoptera).**—*Ecology*, xii, no. 2, pp. 401–422, 7 figs., 16 refs. Brooklyn, N.Y., April 1931.

This report deals with the direct effects of physical factors, such as temperature, moisture, light, barometric pressure, air movement, and nutrition, on the common May beetles in Minnesota. The species studied were *Lachnosterna* (*Phyllophaga*) *implicita*, Horn, *L.* (*P.*) *anxia*, Lec., *L.* (*P.*) *fusca*, Froel., and *L.* (*P.*) *drakei*, Kby. The first of these was the commonest and the chief one studied; others present in smaller numbers were *L.* (*P.*) *futilis*, Lec., *L.* (*P.*) *nitida*, Lec., and *L.* (*P.*) *rugosa*, L.

The following is taken from the author's summary: The optimum temperature for incubation of the eggs of *L. implicita* and *L. anxia* was near 25° C. [77° F.], and 20–73 per cent. saturation of the soil gave satisfactory moisture conditions. The optimum temperature for development of the young larvae of these two species was near 28°C. [82·4° F.], and 25–75 per cent. saturation of the soil was satisfactory. Fully developed larvae of *L. implicita* and *L. rugosa* required 25° C. or higher for pupation. Feeding of the larvae took place largely above 15° C. [59° F.]. Temperatures below freezing destroyed many larvae, although some withstood at least −4° C. [24·8° F.]. The free moisture content of the larvae comprised about 88 per cent. of the total moisture content. Conditions under which the larvae had been kept did not materially affect their content of free moisture. The length of the life-cycle depended on the physical ecological factors.

The minimum limiting temperatures for the adults are dependent upon conditions, but correspond to the order of the spring emergence in the field. The maximum limiting temperatures were approximately

42° C. [107·6° F.] for the species studied. The first emergence depended upon the cumulative effects of heat, the optimum being near 25° C. for *L. implicita*. It was at a minimum at 14° C. [57·2° F.] and was retarded at 30° C. [86° F.]. Daily emergence required a temperature of about 14° C. or higher at the soil surface for *L. implicita*, *L. anxia*, *L. fusca* and *L. drakei*. *L. futilis* responded at a slightly lower temperature. Moisture had very little influence upon emergence in the field. The optimum temperature for oviposition was about 25° C. for *L. implicita* and *L. anxia* and about 20° C. [68° F.] for *L. futilis*. The moisture requirements were limited to between 28 and 58 per cent. of soil moisture saturation. The beetles apparently do not harden to withstand winter conditions. Temperatures below −5° C. [23° F.] killed a majority. The length of exposure was very important. The beetles were capable of maintaining a body temperature at least 9° C. [16·2° F.] above an environment that was only 4° C. [7·2° F.] above the killing point. The free moisture content was approximately the same as for the larvae. Light intensity controlled the time of emergence in the evening and return to the soil in the morning under field conditions. The beetles appeared to be independent of normal air pressure changes. Wind, when strong, controlled the direction of flight and the place of feeding. Morning air currents, even when slight, controlled the direction of flight on the return to the soil.

GRABER (L. F.), FLUKE (C. L.) & DEXTER (S. T.). **Insect Injury of Blue Grass in relation to the Environment.**—*Ecology*, xii, no. 3, pp. 547–566, 10 figs., 2 refs. Brooklyn, N.Y., July 1931.

The injury to blue-grass (*Poa pratensis*) in Wisconsin resulting from the consumption of subterranean growth by larvae of *Lachnosterna* (*Phyllophaga*) spp. is greatly intensified by unfavourable conditions of the external and internal environment of the plant. In order to gain more specific evidence, experiments were undertaken, and are here described, to reproduce such conditions in cultures by definite fertilisation and cutting treatments and by regulation of the moisture supply. From the results, it appears evident that the injury from *Lachnosterna* is lessened when conditions favour the quantitative development of subterranean growth of blue-grass and especially when such factors of the environment augment the regenerative activity of the grass during the feeding period of the insects. It is manifest that the environment of the plant is significant in relation to insect injury.

GLASER (R. W.). **The Cultivation of a Nematode Parasite of an Insect.**—*Science*, lxxiii, no. 1901, pp. 614–615, 2 refs. New York, N.Y., 5th June 1931.

The Nematode parasite, *Neoaplectana glaseri*, Steiner [*R.A.E.*, A, xviii, 112], of the Japanese beetle [*Popillia japonica*, Newm.] was found in a limited area in New Jersey during 1929, 1930 and 1931, high mortality being caused among the grubs. It has not been found in a large number of its host from other parts of New Jersey or from Pennsylvania.

This Nematode was successfully reared on standard meat infusion agar plates containing 1 per cent. dextrose and having a reaction of pH 7·4. Gravid, ovoviviparous females from infested grubs were

placed on the plates together with a water suspension of an actively growing yeast, and after 2 days at room temperature numerous larvae occurred on the plates. Each generation develops in 4–5 days, and transfers were usually made after the second generation. Several cultures have been grown for 5½ months, transfers being made every 10–14 days. After 6 months the Nematodes failed to reproduce, and the majority died. They were repeatedly shown to produce a fatal infestation in beetle larvae, and a six-month-old culture that appeared to have lost its ability to grow was found to be capable of infesting the larvae. The forms obtained from these again produced good cultures. These cultivations make it possible to obtain the worms in large numbers and open up a possible method of controlling *P. japonica*. It is believed that this is the first time that the entire life-cycle of a parasitic Nematode has been obtained on an artificial medium.

Isley (D.), Schwardt (H. H.) & Baerg (W. J.). [**Report on Entomological Work, 1930-31.**]—*Bull. Arkansas Agric. Expt. Sta.*, no. 268, pp. 45–49. Fayetteville, Ark., November 1931.

Investigations were undertaken in 1930 to determine the extent of injury caused by *Lissorhoptrus simplex*, Say (rice water weevil), which occurs every year throughout the rice-growing zone of Arkansas. The adults feed on the leaf blades and the larvae on the roots. The increase in the yield of plots drained early (flooded 20th June and drained 10th July) and late (flooded 14th July and drained early in August) over those that were undrained until harvest might be attributable to causes other than the prevention of infestation. In counts of the larvae, however, made at approximately weekly intervals, the lower yields of the undrained plots were found to be correlated with the greater abundance of larvae in these plots. Furthermore, the weight of the roots of plants from the undrained plots was much less when larval attack was most severe.

In Arkansas, *Loxostege similalis*, Gn. (garden webworm) attacks many plants, preferably lucerne and pigweed (*Amarantus* sp.), from which it migrates to cotton. In midsummer the life-cycle takes about a month. The eggs are laid on weeds growing in or bordering the cotton fields and hatch in about 3 days. The greatest number deposited by one female was 588, and the largest number laid on a single day was 103. The larvae feed on the weeds till they are cut, when they migrate to cotton. In this way infestation may also spread from lucerne to cotton. The larval feeding period lasts 10–21 days, and the period spent in the cocoon 7–13. Oviposition occurs 2 or 3 days after emergence and may last 10–17 days, the eggs usually being laid on the preferred food-plants. Successive generations seldom attack cotton. Control may easily be obtained by dusting with calcium arsenate; weeds in the fields or along their margins should be destroyed as a preventive measure.

Rhizopertha dominica, F., has become of increasing importance as a pest of stored grain in the United States since the War, when large numbers were introduced in wheat from Australia. In Arkansas, stored maize and rice are the grains most severely attacked. Clusters of 4–8 eggs are sometimes laid loosely in the grain, but more often in holes or cracks in the grain or container. Hatching takes place in an average of 6 days during the summer. Larvae that hatched during January 1931 pupated after an average of 39·6 days in a heated room,

but during the summer the larval period may only last 18 days. The larval and pupal stages are passed in the grain, the latter occupying 6 days during February and March. The adults may bore out of the grain in a few days, or remain feeding for two or more weeks.

In life-history studies on *Malacosoma americana*, F. (apple tent caterpillar) on wild cherry trees, eggs deposited on 6th June were found to contain fully developed caterpillars after 23 days. In the later egg masses development was completed in less time, the shortest period being 18 days. Many of the eggs are thus fully developed by 1st July, though they do not hatch until about the middle of March of the following year.

During 1931, *Anthonomus signatus*, Say (strawberry weevil) was present in numbers over a large part of the State, causing injury in all the main strawberry-growing areas. In the north-western counties severe losses resulted, even in areas where this pest had not previously been of economic importance. The most satisfactory preventive measure is the planting of immune varieties. Burning the borders of the beds, especially woodland borders, during the winter [*R.A.E.*, A, xviii, 378] destroys many of the hibernating weevils, though this treatment of the bed itself is not recommended. Clean cultivation will prevent the weevils hibernating in the beds. Dusting with a mixture of one part of lead arsenate to three or four of hydrated lime gave good results. Applications should be made in the early morning and, if rain falls during the next 24 hours, repeated on the following morning. Under favourable conditions, one treatment may be sufficient, but more satisfactory results will be obtained if another is given in 5 or 6 days.

Davis (J. J.). **Insects of Indiana for 1930.**—*Proc. Indiana Acad. Sci.*, xl, pp. 307–320, 3 figs. Indianapolis, Ind., 1931.

Brief notes are given on a considerable number of insect pests recorded in Indiana in 1930.

Ficht (G. A.). **Some observations on the seasonal History of the European Corn Borer, *Pyrausta nubilalis*, Hbn., in Indiana.**—*Proc. Indiana Acad. Sci.*, xl, pp. 335–338, 1 fig. Indianapolis, Ind., 1931.

The following are the author's conclusions :—The average dates of the occurrence of maximum pupation, moth emergence and egg deposition of *Pyrausta nubilalis*, Hb., in Indiana during 1929 and 1930 were 17th June, 5th July and 7th July, respectively. The mean date of the first appearance of infestation of maize was 28th June. The first full-grown larvae appeared on 27th July, and all larvae were in the final instar and full-fed by 27th August. The extreme heat and drought of 1930 were responsible for a slower spread of the borer into new territory, a smaller increase in the intensity of the infestation and a lessened accumulation of borers in the old infested area of Indiana than would have occurred during a normal season. This was brought about by a shortening of the life of adults, a reduction in the number of eggs laid, a relatively high larval mortality at the time of and following the period of hatching and establishment, and a more general and uniform distribution of borers in the infested regions.

Ackerman (A. J.) & Isely (D.). **The Leaf Hoppers attacking Apple in the Ozarks.**—*Tech. Bull. U.S. Dept. Agric.*, no. 263, 40 pp., 14 figs., 45 refs. Washington, D.C., October 1931.

The following is taken from the authors' summary :—An account is given of observations on five species of leafhoppers attacking the foliage of apple in the Ozark district of Arkansas. The species concerned are *Erythroneura obliqua*, Say, *E. maculata*, Gill., *Typhlocyba pomaria*, McAtee, *Empoasca fabae*, Harr., and *E. maligna*, Walsh. The first two are the most injurious, as they are less affected by the dry, hot weather of the region, but none are of primary importance. Other leafhoppers infesting apple are mentioned, but are not dealt with in detail. Descriptions are given of all stages of the five species, with characters distinguishing them, keys to the adults and nymphs and notes on their history, synonymy, distribution and food-plants.

The bionomics of *Erythroneura obliqua* and *E. maculata* are almost identical, both having two generations and a partial third a year. Adults of the third and probably a few of the second generations hibernate. They emerge in early spring when the leaves begin to expand and may continue living until July. Nymphs of the first generation hatch from early May to late June, and adults of all generations may be present on apple at the same time in September. The egg and nymphal stages average 15–16 and 20–21 days, and the life-cycle of the first two generations averages 55 days. *Typhlocyba pomaria* has two generations a year, hibernation occurring in the egg stage. The overwintered eggs, which are deposited under the bark of the young wood, hatch in April. Between mid-June and late July no active stages are seen, eggs deposited on the leaves during May and June hatching from late July to mid-September. The resulting adults are present from about mid-August to early November, oviposition occurring during September and October.

Three generations of *Empoasca fabae* were reared during 1925. The adults emerge from hibernation in April and migrate to apple early in May, when the females are sexually mature. Nymphs of the first generation, which are the only ones that cause injury, are present on apple from early May to mid-July. The development of the immature stages is greatly influenced by climatic conditions, that of the eggs occupying 6–18 days and that of the nymphs 9–30. *E. maligna* has only one generation a year. The eggs are laid in May and June beneath the outer bark of young apple twigs, and hatch in the following April. The insects are present on the trees from April until the end of July, adults occurring in numbers during May and June. The nymphal stage lasts 24–33 days.

Natural enemies are seldom of importance in the control of leafhoppers. Experiments against the nymphs of *E. obliqua* and *E. maculata* show that a spray of nicotine sulphate, 1 : 1,600, with the addition of 1 lb. resin fish-oil soap to each 50 U.S. gals. of spray, will give good commercial control.

Collins (C. W.) & Schaffner, jr. (J. V.). **An Air-pressure Extension Brush for applying Creosote to Gipsy Moth Egg Clusters.**—*Circ. U.S. Dept. Agric.*, no. 204, 7 pp., 4 figs. Washington, D.C., December 1931.

The standard control measures for *Porthetria dispar*, L. (gipsy moth) in the New England States consist of lead arsenate sprays against the

larvae and treatment of the egg-clusters with creosote. The latter has been done by means of hand brushes dipped in small pails of creosote to reach the low clusters, and by brushes mounted diagonally on bamboo poles 15 to 20 ft. long for clusters placed high in the tree or in similar situations. The tendency has been for the workmen to treat too many egg-clusters with one wetting of the brush, with the result that a varying proportion of the eggs in some of the clusters failed to be killed. The authors have therefore devised an extension brush fed by air pressure, which has the advantages of keeping the brush wet, enabling a closed container to be used for the creosote, and saving the time taken in constantly lowering the brush for wetting purposes and the waste of the dripping creosote. The container consists of a brass tank that will hold one U.S. pint of liquid and withstands a pressure of 50lb., air pressure being obtained by means of a small pump. The cost of the whole apparatus, which is fully described and illustrated, is in the neighbourhood of £3. The gregarious larvae of tent caterpillars in their early instars, adult mealybugs, and perhaps other pests might be successfully treated by this method.

STRONG (L. A.). **Report [1930–31] of the Chief of the Plant Quarantine and Control Administration.**—99 pp. Washington, D.C., U.S. Dept. Agric., 1931.

The activities of the Plant Quarantine and Control Administration for the year ending 30th June 1931 are reviewed, and a summary is given of the legislation promulgated in regard to plant quarantines and other regulations. The insect pests dealt with are the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.], the gipsy and brown-tail moths [*Porthetria dispar*, L., and *Nygmia phaeorrhoea*, Don.], the satin moth [*Stilpnotia salicis*, L.], the European corn borer [*Pyrausta nubilalis*, Hb.], the Japanese beetle [*Popillia japonica*, Newm.], the pink bollworm [*Platyedra gossypiella*, Saund.], the thurberia weevil [*Anthonomus grandis thurberiae*, Pierce], the Mexican fruit worm [*Anastrepha ludens*, Lw.], the date scale [*Parlatoria blanchardi*, Targ.], and the narcissus bulb flies [*Merodon equestris*, F., and *Eumerus* spp.].

An account is given of the successful eradication campaign against *C. capitata*, all field activities in connection with which were discontinued on 31st March 1931. High pressure sprayers were used for the first time in applying lead arsenate against the larvae of *Popillia japonica* during the spring of 1931. Constant agitation of the spray mixture in the tanks permitted the successful use of a mixture of 1 lb. lead arsenate to 1 U.S. gal. water. The spray was applied to the ground at the rate of 500 lb. lead arsenate to the acre. Four sprayers were employed on each operation, two in applying the spray and two in supplying the water used to wash the lead arsenate into the soil. The washing operation required the use of 3–4 times as much water as the spray. This method has the advantage of reducing the treating mixture to one-seventh of its former bulk and of requiring transport of the lead arsenate only without the additional 6 parts of tankage and sand. Sufficient data are not yet available for comparing the efficiency of the spray and the dry application. Revision of the treating instructions to permit the application of lead arsenate to nursery plots [*R.A.E.*,

A, xviii, 354], and the subsequent certification of stock therefrom, resulted in over 95 per cent. of the total plants treated being handled in this manner.

Anastrepha ludens was found on 22nd April 1931 after an interval of about 17 months on the United States side of the Rio Grande in Texas, in grapefruit that had been picked on 28th February and kept in storage. A survey was made of the area within a half-mile radius of the infested grove, and all fruit held in storage within it was destroyed. A thorough inspection of all fruit in storage within the quarantined area gave negative results. About 2 years had elapsed since the last previous outbreak of *A. ludens* in this area [xviii, 353]. In the course of continued trapping and inspection operations at Matamoros, Mexico [xviii, 546], an infestation of *A. ludens* was found on 9th April 1931 at one of the places that had been previously infested in 1929, and 13 premises in the city were subsequently found to be infested. Larvae were found in fruit of sour orange, white sapote [*Casimiroa edulis*] and *Sargentia greggii* (another species of sapote). In co-operation with the Mexican officials all sapote and *Citrus* fruits were stripped from the trees and destroyed by burial, and the application of bait-spray at weekly intervals was resumed in the areas surrounding the infested premises. The half-grown or smaller fruits of *S. greggii* appear to be the favoured host-fruits, the larvae feeding in the seed of the immature stages and in the flesh of the maturer stages. A host-free period is maintained from 1st March to 30th September each year within the quarantined area, no fruit likely to be acceptable to *A. ludens* for oviposition being allowed to reach maturity during the summer. Details are given of the system of inspection.

Miller (R. L.) & McBride (O. C.). **Experiments with Copper Carbonate, Lead Arsenate and other Compounds against the Mediterranean Fruit Fly in Florida.**— *J. Econ. Ent.*, xxiv, no. 6, pp. 1119–1131, 8 graphs, 5 refs. Geneva, N.Y., December 1931.

In view of the reduction in acid in maturing *Citrus* fruits caused by the use of bait-sprays containing lead arsenate, which were used in the recent eradication campaign against *Ceratitis capitata*, Wied., in Florida, experiments with various compounds were undertaken to discover an effective substitute.

The following is almost entirely taken from the authors' summary: Copper compounds have been found to be very toxic to *C. capitata* when used in a solution of syrup and sugar. The mean length of life of fruit-flies fed on a mixture of 8 lb. lead arsenate, 50 lb. sugar, 10 U.S. gals. syrup (molasses) and 190 U.S. gals. water was $3{\cdot}69 \pm {\cdot}034$ days after they had been caged with the insecticide. Copper carbonate used at the same strength gave a mean length of life of $4{\cdot}43 \pm {\cdot}050$. The copper compounds had no repellent effect on the flies, but were most toxic at the highest concentration, although remaining quite toxic at very low concentrations. Insecticide mixtures may be diluted with water without reducing toxicity so long as the proportions of insecticide, syrup and sugar are maintained.

A temperature of 92° F. caused the flies to die from 3 to 5 times as fast as they did at 72° F. when they were fed on lead arsenate. Copper carbonate is much more toxic in an acid than in an alkaline suspension. The greater the area covered with the poison to which the flies are

exposed, the more rapid is the kill. In copper compounds, the more soluble the compound the more toxic it is to fruit-flies. The longer fruit-flies have gone without food, the more rapid will be the kill when they are fed on an insecticide. Copper carbonate does much less injury to *Citrus* than lead arsenate, and very little more than a solution of syrup and sugar alone. When the fruit is small, lead arsenate used with the power spray equipment at the rate of ½ U.S. gal. to a tree, and with knapsack equipment at the rate of 2 U.S. gals. to a tree, reduced the anhydrous citric acid in the fruit to nearly one-half the normal amount. The effect of arsenic on the fruit is carried through the leaves and branches to the fruit, but when only the fruit is treated, it alone is affected, while the tree and the remaining fruits remain unaffected.

Drake (C. J.) & Harris (H. M.). **The Pale-striped Flea Beetle, a Pest of young Seedling Onions.**—*J. Econ. Ent.*, xxiv, no. 6, pp. 1132–1137, 2 figs. Geneva, N.Y., December 1931.

An account is given of a serious outbreak of *Systena blanda*, Mels., on young seedling onions in Iowa in June 1931. A field of 8 acres was totally destroyed, and in another field about 75 per cent. of the plants were damaged. Reports indicated that the infestation was widespread and generally harmful. By 5th June 75 per cent. of the larvae had entered the soil to pupate. Of 160 collected in the field on 5th and 6th June, the first entered the prepupal stage in the insectary on 7th June and the last on 23rd June. The first adults emerged on 20th June, when newly emerged adults were also present in the field, feeding on a number of alternative food-plants. Mating was first observed in breeding cages on 23rd June, and oviposition started four days later.

The larvae gnaw small irregular cavities on the sides of the underground portions of the leaf sheath, cut through the rootlets, eat into the base of the stem, destroy the bud, and occasionally even tunnel through the underground part of the plant. One larva may destroy several seedlings, and 2–4 were often found attacking a single plant. Losses occur from early spring to mid-June, the period of development of the overwintered larvae. The larvae make favourable avenues of entrance for disease organisms and may actually inoculate the plants with pathogenic organisms encountered in the soil or carried from one plant to another. Onions growing on upland or well-drained ground are most subject to attack, and losses are heaviest during dry seasons. It appears that when onions follow onions in fields where weeds are systematically destroyed, there is less likelihood of injury than when onions follow some other crop that does not permit of such clean cultivation and that is more attractive to the feeding and ovipositing adults.

Although the adults of *S. blanda* have frequently been recorded as injuring various crops and have been known to feed on over 50 different plants [*cf. R.A.E.*, A, xvii, 161], the larvae have apparently never before been recorded as attacking any crops except maize and sweet potato. Infestation of onions, however, was serious in Iowa in 1924, and some losses are sustained each year. An investigation of infested fields on 26th and 27th June showed the adult beetles feeding on weeds, their numbers varying with the prevalence of the food-plants, which were much more abundant in soy-bean fields than where onions were grown.

Borden (A. D.). **Some Field Observations on Codling Moth Behavior.**— *J. Econ. Ent.*, xxiv, no. 6, pp. 1137–1145, 1 diag., 1 ref. Geneva, N.Y., December 1931.

Data obtained in the course of experiments in an apple orchard in California already noticed [*R.A.E.*, A, xvii, 370] are recorded in relation to the ecological factors governing the flight of *Cydia* (*Carpocapsa*) *pomonella*, L., which include temperature, humidity, light intensity and air movements. The records obtained show that the flight, which is known to take place about sunset, may extend over a period of approximately two hours under favourable conditions, or there may be no flight at all when the temperature is too high or too low, or when it is windy. The maximum number of moths in flight for any one evening occurs in the period immediately before or after sunset, and usually within twenty minutes of it. Light intensity records adjoining the tree area at that period show a range of 25–52 foot candle, the variation in the tree area being due to the effect of shadow or slanting rays of light in the higher tops. The time, distance and manner of the flight of the moths are discussed in detail, and the method of oviposition is described. Although some eggs are probably laid before and after the sunset period, the majority are deposited within it and at temperatures ranging from 60 to 69° F.

The maximum temperature at which flight has been observed to start in one district near the coast where temperature and humidity are influenced by fog is 78° F., and whereas the minimum temperature for this district is 54° F., moth flight usually ceases at 58° F. Excessively high temperatures in the early part of the evening exercise a decided check on flight during June and July. Both bright sunlight and darkness undoubtedly check flight, and the faintest air movement in the tree-tops effectively reduces it. Few if any moths were observed on evenings when wind was blowing, even when temperatures and light intensities were favourable. Studies of bait traps indicated that during the season sunrise flights had taken place on two occasions when morning temperatures were abnormally high. The use of the bait pan for indicating moth activity, which has been tested for 4 seasons, has been found of value.

Steiner (L. F.) & Marshall (G. E.). **Four Years' Experiments with chemically treated Codling Moth Bands.**— *J. Econ. Ent.*, xxiv, no. 6, pp. 1146–1151, 3 refs. Geneva, N.Y., December 1931.

Much of the information contained in this paper, which records the results of an investigation on the use of chemically treated corrugated paper bands against the codling moth [*Cydia pomonella*, L.], carried on in Indiana since 1927, has already been noticed [*R.A.E.*, A, xix, 689]. The alpha-naphthylamine combination appears under Indiana conditions to be superior to the beta-naphthol one in effectiveness and attractiveness to the larvae, but both materials almost entirely prevent adult emergence, which has never exceeded 2 per cent. of the larvae captured.

Batchelder (C. H.) & Questel (D. D.). **Insecticidal Control of the European Corn Borer : the Problems involved and some experimental Results.**— *J. Econ. Ent.*, xxiv, no. 6, pp. 1152–1167, 1 pl., 7 refs. Geneva, N.Y., December 1931.

Laboratory and field investigations on the use of insecticidal sprays against *Pyrausta nubilalis*, Hb., on maize were conducted during 1927–

1929 in Massachusetts and Ohio with a view to providing a remedy that will reduce indirect borer injury due to tunnelling and at the same time afford protection to the ear. The more important problems encountered included the timing of applications owing to variation in the period of oviposition, maintenance of a spray cover in important feeding areas such as interfoliar spaces, and application to tall varieties of late maturing maize infested by the second generation in the two-generation area. *P. nubilalis* usually adopts the habit of tunnelling the stalks in the second or third larval instar, up to which it is exposed to the action of ovicides and larvicides. In the case of the single or of the first generation, the height of the plants does not preclude the application of insecticides by ordinary mechanical methods. The protracted oviposition period and the rapid growth of the plants during the period of initial infestation render 2–4 applications necessary to ensure satisfactory control. Present information indicates that insecticidal practice should be governed by the following assumptions : the occurrence of a dispersal migration immediately following hatching ; the success of a small percentage of these larvae in reaching the interfoliar spaces between rapidly growing leaves ; and survival largely dependent upon success in arriving at these situations in a minimum time.

The results are given of a number of tests carried out to determine the relative effectiveness of various insecticides. Laboratory experiments showed that eggs of *P. nubilalis* failed to hatch when sprayed with a 1 per cent. oil emulsion, but neither acid lead arsenate nor any oil emulsion investigated gave satisfactory control under field conditions when used alone. The most satisfactory oil from the standpoint of tolerance of the maize plant was found to be a highly refined medium paraffin oil (viscosity 70–85 seconds Saybolt at 100° F.). A combination of a lead arsenate suspension (2 lb. to 50 U.S. gals.) in a 1 per cent. oil emulsion was found so to reduce the interfacial resistance of appressed leaf blades and the surface tension of the lead arsenate suspension as to induce penetration of these materials into the interfoliar spaces, where *P. nubilalis* habitually feeds during the early larval stages. The lethal margin of this combination over other arsenicals may be due to the combined value of the egg-destroying capacity of the oil and the larvicidal action of the arsenical. The main reduction in corn borer population in plots treated with this combination was attributable to two of the applications, and less than four applications, correctly timed, would have been sufficient to afford satisfactory control. Insecticides involving the use of nicotine and pyrethrum as well as several other materials of the contact insecticide type were found impractical in their present physical form for use against this moth.

Hinds (W. E.) & Osterberger (B. A.). **The Soybean Caterpillar in Louisiana.**—*J. Econ. Ent.*, xxiv, no. 6, pp. 1168–1173, 4 refs. Geneva, N.Y., December 1931.

Further data in relation to *Anticarsia gemmatalis*, Hb., attacking soy-beans in Louisiana [*R.A.E.*, A, xviii, 678, 679] are given as the result of observations of the 1930 outbreak, which was neither so extensive nor so serious as that of 1929. Cowpeas reported as untouched in 1929 were more readily attacked than velvet beans [*Stizolobium*] at Baton Rouge in 1930, and coffee weed (*Sesban macrocarpa*) was

found to be another alternative food-plant. The first larvae were observed in the southern part of the State on 13th June and probably represented the first generation, scattered larvae found in late July and early August being attributed to the second and the stripping of soy-beans that occurred during September to the third. The final or fourth generation decreased throughout October and disappeared before the first frost. Development of the third generation, which apparently began in early August, was rapid and infestation steadily increased, but no general stripping took place before the middle of September. In 1929 and 1930 most of the perforation of foliage that occurred during the early part of the season was due to *Cerotoma trifurcata*, Forst., and other leaf-eating insects. In 1930 at least 90 per cent. of the soy-bean crop was harvested before *A. gemmatalis* did any measurable amount of damage, and injury was confined to late-planted soy-beans and to areas where the maturing of seed was desired. Defoliation in 1929 was sufficiently early and general to prevent maturity, but this was not the case in many fields in 1930.

In the insectary the pupal period averaged from 8 days at 74·6° F. to 22 days at 61° F. Observation of pupation showed a strong tendency to concentrate in loose areas of soil, as many as 30 pupae being found in 100 sq. ins. of soil surface. Pupation generally occurred between the surface under rubbish and a depth of 5 ins., in special loosened soil, but was occasionally observed on leaves on the plants. Hard areas showed very few pupae. Adults from the September generation of larvae emerging during October were abundant in the fields for several weeks, but no further development of larvae or stripping of soy-beans occurred after this time.

Insecticidal control is recommended only where necessary to allow maturity of a desired seed crop, and has been found practically possible by dusting with sodium or barium fluosilicate at the rate of 15–16 lb. to the acre. The most abundant of the 4 species of primary parasites of *A. gemmatalis* was *Winthemia rufopicta*, Big., 70 per cent. of the larvae in some collections bearing eggs of this Tachinid. *Sarcophaga rapax*, Wlk., was also bred frequently, and the Ichneumonids, *Pimpla* (*Ephialtes*) *aequalis*, Prov., and *Ophion bilineatus*, Say, were reared from the pupae but were not abundant. Numerous specimens of *Megaselia dyari*, Malloch, were bred from dead pupae, but it is doubtful whether they are true parasites. Predators included various birds; several species of Vespoid wasps; *Solenopsis geminata*, F.; *Calosoma sayi*, Dej., in both larval and adult stages; and three Pentatomids, *Podisus maculiventris*, Say, *Proxys punctulatus*, P. de B., and *Stiretrus anchorago*, F. The fungus, *Spicaria prasina*, was an extremely important factor in checking the final autumn generation of larvae. The occurrence of *A. gemmatalis* should not be considered a serious obstacle to soy-bean cultivation in Louisiana.

Moreland (R. W.) & Bibby (F. F.). **Field Tests in Texas of Insecticides for Control of the Cotton Bollworm** (*Heliothis obsoleta* **Fab.**).—*J. Econ. Ent.*, xxiv, no. 6, pp. 1173–1181. Geneva, N.Y., December 1931.

The following is taken from the authors' abstract and summary: During the past several years, damage to cotton by *Heliothis obsoleta*, F., has been increasing both in severity and regularity, particularly in the western portion of the Cotton Belt, and the control measures practised

have ceased to be adequate under modern conditions. The results are given of field experiments carried out in Texas over three seasons in the control of *H. obsoleta* by dusting with arsenicals. It was found that infestation was not increased when calcium arsenate or other dusts were applied to the cotton [*cf. R.A.E.*, A, xviii, 64 ; xix, 92]. An increased yield was obtained throughout the experiments in cotton treated with insecticides, whatever the material used and regardless of whether the number of applications was moderate or excessive. The difference in yield between plots treated with a commercial mixture of 75 per cent. calcium arsenate and 25 per cent. Paris green and those treated with calcium arsenate alone was insignificant. The application of sodium fluosilicate dust to cotton gave but slight if any control in 1928 ; in 1929 the plot treated with this material yielded more cotton than the untreated plot, but not so much as that treated with calcium arsenate.

Although in all these tests there was some gain in yield regardless of the advancement of the infestation at the time applications were begun, the best results were obtained when treatment was started at the time the first brood of the bollworm appeared and continued regularly at proper intervals. As fruit set late in the season is likely to be prevented by frosts from maturing, it does not seem advisable to defer applications too long.

YETTER, jr. (W. P.) & STEINER (L. F.). **A preliminary Report on large-scale Bait Trapping of the Oriental Fruit Moth in Indiana and Georgia.**—*J. Econ. Ent.*, xxiv, no. 6, pp. 1181–1197, 1 ref. Geneva, N.Y., December 1931.

Bait trap experiments against *Cydia* (*Laspeyresia*) *molesta*, Busck, each involving areas of 500 acres, were begun in 1930 in two localities situated respectively in Indiana and Georgia. The results obtained, although inconclusive, are discussed in detail. Whereas in Indiana a molasses-citral bait failed to give any evidence of control, in Georgia a peach-juice granulated sugar combination appeared somewhat to reduce infestation, though the lightness of the infestation and the unusual seasonal conditions apparently so affected the results that they are not convincing. The overwintering brood appeared larger in the unbaited area in Georgia and in the baited area in Indiana, where a total peach crop failure together with severe drought complicated results.

A large number of other possible baits were tested at each locality. Among 414 solutions tested in Georgia, over 40 proved superior to that employed over the large area, which was less than 25 per cent. as attractive as a combination of 10 drops ethyl cinnamate in 1 U.S. quart of 10 per cent. medium brown sugar solution. In Indiana, where the experimental baits were definitely more attractive than molasses-citral throughout the season, the most attractive solution was a combination of methyl cinnamate and brown sugar.

In Georgia 69 and 78 per cent. recoveries were made within 5 days, of marked moths released inside a 14-acre experimental block, where 10 per cent. of a release made in an unbaited peach orchard more than $\frac{1}{4}$ mile away were also recovered. There is evidence that, following emergence, many of the moths travel more than 200 yards before beginning to oviposit. Very few eggs were deposited by moths before their capture. Experiments with released moths indicate that a small

baited block, containing 1,000 traps or less, if surrounded by unbaited peaches, may draw more moths from the unbaited territory than were naturally present in the orchard baited. Both in Indiana and Georgia the small 8- and 14-acre blocks containing experimental solutions averaged respectively 12 and 5 times as many moths to a trap as the large 500-acre areas.

Releases of *Macrocentrus ancylivora*, Roh., were made in Georgia half a mile from the baited area, and this parasite was reared from twig collections in 3 of the baited and 6 of the unbaited orchards, one mile of baited territory being between two of these orchards and the point of release. No evidence was found that might indicate that the bait traps would affect the establishment of this parasite.

Fenton (F. A.) & Owen, jr. (W. L.). **Hibernation of** *Pectinophora gossypiella* **in Texas.**—*J. Econ. Ent.*, xxiv, no. 6, pp. 1197–1207, 1 pl. Geneva, N.Y., December 1931.

Average data are presented from experiments conducted from November 1927 to August 1930 in two localities in Texas, to determine the overwintering survival of *Platyedra* (*Pectinophora*) *gossypiella*, Saund. The types of soil represented were light sandy; heavy silty clay, or adobe; and a mixed sandy adobe with the latter predominating. It was found that in the cotton field 68·59 per cent. of the hibernating stages were in the bolls on the stalks, 29·23 per cent. in shed bolls or cocoons in ground surface trash and 2·18 per cent. in cocoons on tap roots of the plants or in the soil. According to examinations of material in March, the mortality of larvae in bolls on plants was 63·97 per cent., in surface bolls unirrigated 58·68 per cent., and in surface bolls irrigated 61·46 per cent. Averages for 3 years and all types of soil without irrigation show that the final survival in bolls buried 4 ins. was greater than in bolls on the surface of the soil, though this ratio was reversed in sandy loam soil or when bolls were buried in March. An irrigation of surface bolls increased survival. March burial at 4 ins. produced greater mortality than December burial at the same depth without irrigation in either case. Immediate irrigation of bolls buried 4 ins. caused much higher mortality under certain conditions than occurred in bolls buried at the same depth but not irrigated, but three-year averages under such irrigation in all soil types studied and for all months show very little difference. Delaying irrigation three months after burial greatly increased survival over that in bolls buried 4 ins. and irrigated at once. The type of soil has an important effect on survival. About four times as many moths emerged from bolls under the various treatments in silty-clay soil as in sandy loam soil, the figures being 2,465 and 696 respectively. By months, the cumulative larval mortality percentages in bolls under all treatments, except on plants, were as follows: March, 67·27; April, 90·56; May, 95·16; June, 95·75. Based on emergence records, survival from 1927 to 1930 was 3·97 per cent.

Frost (S. W.). **The Well-marked Fruit-worm,** *Stenoma algidella*, **Walk.**—*J. Econ. Ent.*, xxiv, no. 6, pp. 1208–1213, 1 pl., 1 fig., 1 map, 6 refs. Geneva, N.Y., December 1931.

Stenoma algidella, Wlk., which is recorded for the first time as a pest on apple, occurs commonly throughout the eastern United States, and

during recent years has been found in numbers in many orchards in Pennsylvania [*cf. R.A.E.*, A, x, 68], at times causing conspicuous injury, though in view of the sporadic nature of the outbreaks, it is considered to be as yet of only minor importance. Its history, synonymy, abundance and distribution are briefly discussed, and all its stages are described. The larvae make large holes in the leaves of apple, which they sometimes skeletonise, and cause deep cavities in the fruit. They often feed between two adjacent leaves or fasten a leaf to a fruit and feed between them.

Hibernation occurs as a pupa in curled dried leaves without any definite cocoon, and there is only one complete generation a year. Most of the moths usually emerge during the first two weeks of May. They are apparently only slightly attracted to sweetened baits or lights. The maximum number of eggs observed to be laid by one female was 69. They are deposited on the upper surface of the leaf and may be found in the orchard from 15th May till 1st June, when the first larvae pupate. Most of the larvae, however, continue feeding throughout the summer and even as late as September or October. The larvae are conspicuous feeders on apples during the latter part of the summer. A few pupate in June or July and give rise to moths the same year, producing a partial second generation. The Chalcidoid parasites, *Comedo orgyiae*, Fitch, *Syntomosphyrum esurus*, Riley, and *Elachertus proteoteratis*, How., have been reared from the larvae, and an unidentified Tachinid from a pupa. The best method of control is the application of lead arsenate sprays in May, when the maximum number of larvae are present and before they have taken shelter in curled leaves.

DeLong (M.). **The more important Species of Leafhoppers affecting the Apple.**—*J. Econ. Ent.*, xxiv, no. 6, pp. 1214–1222, 3 figs., 11 refs. Geneva, N.Y., December 1931.

Brief descriptions are given for the identification of each of the 12 species of leafhoppers liable to become important pests of apple in one or more areas of the United States, and common names are suggested for each. Of the various species, *Gypona octolineata*, Say, has one generation a year and hibernates in the egg stage. Eggs hatch in Ohio in May and early June, and the nymphs feed on apple during the first and sometimes part of the second instar. Under normal conditions they then leave apple and mature on herbaceous plants, returning to the apple trees in late summer or early autumn. The eggs are laid singly in the new twigs, usually 5–7 in a row, end to end along the twig, separated from each other by about the length of a puncture on the bark. Little economic injury results from feeding, but considerable damage is caused by the egg punctures, especially to young trees. *Idiocerus flavidorsum*, A. & S., has practically the same cycle. Although only a minor pest of apples, it occurs in considerable numbers in Ohio. *Empoasca maligna*, Walsh, and *E. fabae*, Harr., both occur on apple, and the former overwinters on apple in the egg stage, the nymphs hatching in the latter half of May. There is one generation a year, and the eggs are laid in the late summer or autumn. The method of hibernation of *E. fabae* remains unknown, in spite of considerable investigation. It is already in the adult stage when it appears on economic plants in late May or early June, whereas all known forms of hibernating leafhoppers in the same area appear in April or early May. It is suggested that there may be an alternative

wild food-plant on which it hibernates in the egg stage, or it may hibernate only in areas further south and migrate in spring to the northern States.

Of the three species of *Typhlocyba* occurring on apple, *T. pomaria*, McAtee, is the commonest and most widespread. *T. rosae*, L., which has frequently been confused with it, only occasionally occurs on apple. *T. xanthippe*, McAtee, becomes very abundant in certain areas in the eastern United States. These three species, the life-cycles of which are very similar, hibernate in the egg stage; hatching occurs about the middle of May, and there are two generations a season in Ohio. The development of *T. rosae* and *T. xanthippe* is practically identical, except that the latter normally occurs on apple and the former on rose.

The many species of *Erythroneura* that may at times occur in numbers on apple include *E. ziczac*, Walsh, *E. lawsoniana*, Bak. (*dorsalis*, Gill.), *E. obliqua*, Say, *E. harti*, Gill., and *E. maculata*, Gill. The last four, the life-cycles of which are well-known, hibernate as adults in fallen leaves and frequently emerge in March or April. They at first become abundant on succulent foliage of shrubby plants and vines, migrating to apple as soon as the leaves appear and laying their eggs in late May or early June. Two generations occur in the case of each species, the eggs of the second being laid in late July or early August.

Bliss (C. I.), Broadbent (B. M.) & Watson (S. A.). **The Life History of the California Red Scale** *Chrysomphalus aurantii* **Maskell: Progress Report.**—*J. Econ. Ent.*, xxiv, no. 6, pp. 1222–1229, 3 graphs. Geneva, N.Y., December 1931.

In view of the recent increase in the resistance of *Chrysomphalus aurantii*, Mask., to hydrocyanic acid gas in southern California, which may be due either to a selective change in the original population or to its replacement by a resistant strain spreading from some other locality, a further investigation of the life-history of the scale was begun in 1930.

The following are the authors' summary and conclusions: Field collected adult females on green lemon fruits produced an average total of 73 crawlers, but at the time of death they contained a mean number of 42 embryos in various stages of development, some of which should probably be added to the expected productivity. The length of the three female instars in batches reared on green lemon fruits cut with stem was somewhat shorter than in others reared on potted seedlings. The length of each instar was dependent primarily upon the average mean temperature. The effect of temperature was least marked in the first instar and most important in the third, a stage which was defined to cover the period from the termination of the second moult to the first appearance of crawlers outside the female scale covering. On the basis of curves relating development to temperature and the normal temperatures for Los Angeles, three generations a year would be expected for scales developing under shaded conditions equivalent to those in the insectary.

Natural mortality following settling was greater in the last instar than in the two earlier stages. For individuals starting development in late summer, it averaged during the entire developmental period 33 per cent. on lemon fruits and 43 per cent. on *Citrus* seedlings. Scales that

settled in September or later in the season showed an increasing mortality as winter approached, which equalled 100 per cent. for those starting development in November and December. In the spring the mortality decreased.

CARTER (W.). **The Use of Insecticides on Pineapple Plants in Hawaii.**— *J. Econ. Ent.*, xxiv, no. 6, pp. 1233–1242, 2 pls., 4 refs. Geneva, N.Y., December 1931.

In view of the importance of *Pseudococcus brevipes*, Ckll., in the transmission of pineapple wilt in Hawaii [*R.A.E.*, A, xix, 676] and the failure of the parasites and predators hitherto introduced to control it, studies of insecticides have been carried out as a means of temporary control while the search for more suitable parasites is continued. Dipping and spraying tests in the laboratory and field tests in which the material was applied by means of a specially designed machine at a pressure of 200 lb. at the nozzles showed that various commercial oil emulsions provide a satisfactory means of control. The new equipment makes it possible to apply a fine spray direct to the heart of each individual pineapple plant, where the mealybugs are found, and to drive the material between the closely appressed leaves. The volume of material used varies greatly with the size of the plant and type of planting, but between 400 and 500 U.S. gals. of spray to the acre is probably an average amount on young plants. The application of 1·2 per cent. tobacco dust was found to be ineffective. The susceptibility of the plants to scorching imposes severe restrictions in the use of oil emulsions as well as of mixtures of the tank-mixture type, which, however, can be made for two-thirds the cost of commercial emulsions and with adequate supervision can be successfully used.

BULLIS (D. E.). **Some Factors affecting the Composition of dry Lime-sulfur Solutions.**— *J. Econ. Ent.*, xxiv, no. 6, pp. 1247–1252, 3 refs. Geneva, N.Y., December 1931.

In view of the contradictory data published in regard to the effectiveness of sprays of dry lime-sulphur in the control of scale-insects [*R.A.E.*, A, xiv, 168], certain of the factors affecting the composition of solutions prepared from it, which have been found to vary widely, have been studied with the object of facilitating the interpretation of results obtained in the field. Dry lime-sulphur contains about 65 per cent. of calcium polysulphides, 8 per cent. of calcium thiosulphate and and calcium sulphate, and variable amounts of stabiliser and moisture. The liquid lime-sulphur from which it is prepared contains approximately 30 per cent. calcium polysulphides, 2 per cent. calcium thiosulphate, traces of calcium sulphate and the remainder water. It has a specific gravity of 32 or 33° Bé. (1·283 to 1·295). The evaluation of liquid or dry lime-sulphurs for use against scale-insects is generally considered as best represented by the monosulphide : sulphide ratio, which in reality is an expression of the atomic ratio of calcium to sulphur combined in the form of polysulphides. The points considered are the method of preparing the solution and the effect on the composition of solutions of dry lime-sulphur of time, temperature and concentration.

A method of solution by which flasks containing the sample made to volume were immersed in a constant temperature bath for 20 hours

with occasional shaking was found to produce a higher polysulphide sulphur content, a smaller residue of sludge and a higher ratio of sulphide to monosulphide sulphur than that used by the U.S. Food, Drug and Insecticide Administration, which involves stirring the sample with small portions of water and decanting through a filter until the proper volume of solution is obtained. Analyses of solutions made by these two methods at 25° C. [77° F.] and 30° C. [86° F.] are shown. The results obtained in a series of experiments, in which all solutions used were prepared according to the first method (which probably approximates more nearly to that produced in the spray tank), indicate that the value of solutions of dry lime-sulphur for Coccid control may be increased by allowing a longer time for the solution to take place, by increasing the temperature of the water used to prepare the solution, and by improving the monosulphide : sulphide ratio through increasing up to 50 lb. the amount of dry material added to each 100 U.S. gals. water. A combination of temperature increase and higher concentration of dry material produces a spray solution with an analysis that approximates very closely to that of a good quality liquid lime-sulphur, and it is believed that when used at equivalent strength it should give as satisfactory control of scale insects.

Cressman (A. W.), Bliss (H. H.) & Haas, jr. (A. J.). **Suggestions concerning the Analysis of Potash Fish Oil Soap used for Emulsification.**—*J. Econ. Ent.*, xxiv, no. 6, pp. 1252–1255, 5 refs. Geneva, N.Y., December 1931.

A modified form of reporting analysis of fish-oil soap to give the characters important in emulsification is suggested.

McLean (H. C.) & Weber (A. L.). **Use of wetting or degumming Agents in the Removal of Spray Residues from Apples.**—*J. Econ. Ent.*, xxiv, no. 6, pp. 1255–1261, 2 refs. Geneva, N.Y., December 1931.

The results of numerous experiments indicate that certain textile wetting or degumming agents, used in conjunction with dilute hydrochloric acid or a mixture of dilute hydrochloric acid and salt, will satisfactorily remove arsenical residues from New Jersey apples receiving 6 to 8 heavy applications of lead arsenate in cover sprays of which 1 to 4 contained oil emulsion. In most cases application of heat to the cleaning solution was unnecessary. Rapid and effective contact is established between the acid and lead arsenate by the use of wetting or degumming agents. In the course of the investigation it was found that "Alkanol B," one of the degumming agents tested, was an excellent spreader for oil. Limited laboratory experiments indicate that if it were possible to use this material as a spreader in the lead arsenate and oil emulsion spray mixtures, the subsequent removal of residues with the dilute hydrochloric acid solution would be greatly facilitated. The use of a commercial material, which is a mixture of alcohols and ketones containing 6–10 carbon atoms, at a solution of 0·1–0·2 per cent. prevented the foaming that occurs in commercial washers when wetting and degumming agents are employed in admixture with dilute hydrochloric acid.

PARFENTJEV (I. A.). **The adhesive Strength of arsenical Insecticides.**—*J. Econ. Ent.*, xxiv, no. 6, pp. 1261–1263, 1 pl. Geneva, N.Y., December 1931.

An apparatus for testing the adhesiveness of dust insecticides consists of two identical polished metal plates fastened to an inclined frame, to the back of which is attached a small hammer that automatically strikes the frame. About 0·2 gm. of weighed sample is passed through a 40-mesh screen in such a way as to distribute the dust evenly on the upper part of the plate. The amount that falls down after ten successive beats of the hammer is caught and weighed, the loss of weight being due to adhesion. Very stable and uniform results were obtained by this method in testing the adhesion of several brands of lead arsenate, and it was successfuly applied to the dusting of leaves, which were spread over the metal plate. Leaves of different kinds retain varying amounts of insecticide dust, these, however, being in the same proportion as those observed on the metal board.

MORRILL (A. W.). **A Discussion of Smith and Flanders' *Trichogramma* Fad Query.**—*J. Econ. Ent.*, xxiv, no. 6, pp. 1264–1273, 13 refs. Geneva, N.Y., December 1931.

By means of extensive quotations from the literature and other unpublished data, an attempt is made to discount the doubts expressed in a paper previously noticed [*R.A.E.*, A, xix, 543] on the value of work with *Trichogramma* in the control of various insect pests. In dealing with the limited area of dispersal of the parasites insisted upon by Smith and Flanders, the author states that according to his own observations it is usual for *Trichogramma* to spread through a cotton field much faster than could be accounted for if it were assumed that the ability of the adults to spread by flight or air currents is limited to a distance of 50 or even 100 ft. from the point of liberation. The question of variation in the percentage of parasitism in relation to host density is discussed. In cases in which the host occurs in more or less distinct broods and its population reaches a maximum before *Trichogramma* can spread and multiply to a reasonably effective degree, 10 per cent. parasitism in early summer is likely to be of more value to the crop than 80 or 90 per cent. in early autumn. The necessity of basing final conclusions upon actual field experiences regardless of theoretical considerations is insisted upon. Two or more host species frequently complicate the environmental factor and may constitute a decisive element in the acceleration of the multiplication of the parasite. In certain arid districts of the southwestern United States, where the bollworm [*Heliothis obsoleta*, F.] destroys more than 50 per cent. of the cotton crop, the egg population of this moth alone may not afford the opportunity for the attainment of effective control by *Trichogramma*. When, however, the host population is greatly and very rapidly increased by the appearance of the cotton-leaf worm [*Alabama argillacea*, Hb.], the situation is entirely changed. Where *H. obsoleta* is capable of producing extensive damage, the use of maize planted at intervals in the cotton field for the concentration of host eggs and parasites may be a matter of great importance. It is, however, pointed out that even for a given crop, conditions differ in different localities, so that colonisation of parasites, which may have proved beneficial in one environment, may be of questionable or of no value in another. The ability of *Trichogramma* to persist in many localities

throughout the year is known to be dependent on a proper succession on host insects, and there is very strong evidence that the parasite becomes entirely extinct throughout considerable areas each year. Natural parasitism has also been shown to vary greatly in intensity with the diversity of vegetation and host insects, or in some cases with the presence or absence of air currents facilitating spread. A serious outbreak of *H. obsoleta* in Arizona in 1923 was found to have been due primarily to the absence of natural parasitism by *Trichogramma*.

It is considered advisable to adopt any practicable cultural measures to protect *Trichogramma* in cotton fields during the winter and spring, in order to ensure a gradual appearance of the adults from the time of the appearance of host eggs through the critical period for the crop, and also to have parasites introduced in all parts of the field at intervals of a few days throughout the growing season so as to ensure the existence of nuclei for their multiplication and spread.

Common Names of Insects approved for general Use by the American Association of Economic Entomologists.—*J. Econ. Ent.*, xxiv, no. 6, pp. 1273–1310. Geneva, N.Y., December 1931.

This list, which combines with the popular names hitherto approved by the Association those having received the necessary vote for adoption in 1931, supersedes all previous ones [*R.A.E.*, A, xiii, 429, etc.].

Stanley (W. W.). **Altitude Records for** *Diabrotica duodecimpunctata* **(Fabricius) in Tennessee.**—*J. Econ. Ent.*, xxiv, no. 6, p. 1311. Geneva, N.Y., December 1931.

Adults of *Diabrotica duodecimpunctata*, F., were observed on 25th October 1931 at an altitude of 6,430 ft. on a mountain peak situated on the boundary line between Tennessee and North Carolina. The collection of this beetle is also recorded from the top of a 19 storey building in Knoxville, Tennessee, on 17th September 1931.

Harris (H. A.). **Twelve-spotted Asparagus Beetle in Iowa.**—*J. Econ. Ent.*, xxiv, no. 6, p. 1311. Geneva, N.Y., December 1931.

Since the first appearance of *Crioceris duodecimpunctata*, L., in America, near Baltimore, in 1881, 20 years after the first discovery of *C. asparagi*, L., the two pests have spread rapidly, the former species seeming always to follow the latter into new territory. Although *C. asparagi* appeared in Iowa about 1920 and has since devastated the asparagus crop in many parts of the State, *C. duodecimpunctata* was not observed until 1931, when it was recorded in several fields near Davenport. It reached Illinois in 1925, but had not previously been recorded from west of the Mississippi river.

Marelli (C. A.). **Recientes observaciones sobre los taladros del genero** *Platypus* **en algunos arboles del Jardin Zoológico.** [Recent Observations on Borers of the Genus *Platypus* in some Trees in the Zoological Garden at La Plata.]—*Maderil*, iii, no. 31, pp. 5–10, 9 figs. Buenos Aires, January 1931. [Recd. December 1931.]

Platypus sulcatus, Chapuis, has been observed infesting *Casuarina*, *Platanus*, *Populus* and *Eucalyptus* at La Plata, Argentina. Its mines are described in detail and compared with those of other species of the genus.

Marelli (C. A.). **Liberaciones del parásito del gorgojo de los eucaliptos efectuados en el bosque de La Plata.** [Liberations in the Park at La Plata of the Parasite of the Weevil infesting *Eucalyptus*.]—*El Argentino*, no. 9382, p. 2. La Plata, 15th October 1930. **Experiencia de gabinete con una segunda generación argentina de la avispita destructora de los desoves del gorgojo de los eucaliptos.** [Laboratory Work with a second Argentine Generation of the Parasite of the Eggs of the Weevil attacking *Eucalyptus*.]—*Maderil*, iii, no. 29, pp. 8–10, 1 fig. **La tercera generación del Microhimenóptero predator útil a los eucaliptus obtenida durante Noviembre en el bosque de La Plata.** [The third Generation of the Hymenopterous Parasite beneficial to *Eucalyptus* obtained in November 1930 in the Park at La Plata.]—*T.c.*, no. 30, pp. 8–10, 4 figs. Buenos Aires, 1930.

These articles describe a further importation from South Africa and liberations at La Plata, Argentina, of the Mymarid parasite, *Anaphoidea nitens*, Gir. (*gonipteri*, Ferrière) for the control of the weevils [*Gonipterus* spp.] attacking *Eucalyptus* [*R.A.E.*, A, xvii, 279, etc.], the breeding in the laboratory of a second Argentine generation of the parasite, and the occurrence of a third generation in the field.

MacDougall (R. S.). **Insect Pests. No. xiii.**—*Scot. J. Agric.*, xv, no. 1, pp. 48–58, 4 figs., 14 refs. Edinburgh, January 1932.

In this continued paper [*cf. R.A.E.*, A, xx, 1] notes are given on the Tipulids attacking crops in Britain, including a discussion on the bionomics and control of *Tipula oleracea*, L., and *T. padulosa*, Mg., a key for distinguishing them and a closely related British species, *T. czizeki*, De Jong, and a very brief account of the Bibionid flies, the larvae of which are often confused with those of Tipulids, followed by notes on the life-history and control of *Pegomyia hyoscyami* var. *betae*, Curt., on sugar-beet.

Massee (A. M.). **The Blackberry Mites.**—*J. Pomol. Hort. Sci.*, ix, no. 4, pp. 298–302, 7 refs. London, December 1931.

Brief notes are given on the species of *Eriophyes* that attack plants of the genus *Rubus*, two of which are widely distributed in Britain, namely, *E. gracilis*, Nal., which is common on raspberries, and *E. gibbosus*, Nal., which is often found on wild blackberry. *E. essigi*, Hassan, which is described in detail, is recorded for the first time in this country. It is of considerable economic importance on cultivated blackberries in Kent, on which it causes the condition known as redberry [*cf. R.A.E.*, A, xvi, 443]. It hibernates from September to February under the bud-scales and on the shoots of the plant, becoming active in spring, as soon as the growth begins to develop. The mites feed among the fine hairs on the lower surface of the leaves and petioles, and later in the season on the flowers. As soon as the petals fall, the drupelets are attacked, with the result that the fruits in many instances become distorted. The berries ripen prematurely when the infestation is very severe, and many of them remain on the plants in a dried condition until the following spring. Although one application of a spray of lime-sulphur, 1 : 99, during June, just before the flower buds opened, did not entirely eradicate infestation, considerably less fruit was injured on the treated bushes than on the untreated ones.

Plantesygdomme i Danmark 1930. [Plant Diseases and Pests in Denmark in 1930.]—*Tidsskr. Planteavl*, xxxvii, pp. 458–508, 2 graphs, 8 figs.; also as *Oversigt St. Plantepat. Forsøg.*, no. 47. Copenhagen, 1931. (With a Summary in English.)

Pests occurring in Denmark in 1930 included: *Agriotes* sp., which was exceedingly injurious, particularly to barley grown after beet or on old meadows; *Phyllotreta vittula*, Redtb., which was also more than usually injurious to cereals following grass, 60–70 per cent. of oats and barley being destroyed in Schleswig; *Tipula paludosa*, Mg., which caused much damage in Jutland, where abundant rain in August 1929 had favoured oviposition; *Contarinia tritici*, Kby., which caused severe injury to wheat in central and southern Zealand; *C. nasturtii*, Kieff., which was common on swedes in early summer, although the secondary attack of bacterial rot failed to appear and the damage was slight; and *Pegomyia hyoscyami*, Panz., the first generation of which did very serious damage to beet although the second was of no importance. Outbreaks of *Melolontha melolontha*, L. (*vulgaris*, F.), which had been rare since 1903, occurred in 1925, 1929 and 1930 in southern Zealand. Spraying with lead arsenate seemed to decrease the vitality and oviposition of the beetles. Mines observed in apples in several localities in the autumn were found to be the work of the larvae of *Blastodacna putripennella*, Zell., which normally hibernate under the bark. *Bibio ferruginatus*, L., which is recorded for the first time as a pest, attacked barley following root crops, but almost exclusively where farmyard manure had been applied in abundance. It was sometimes accompanied by *Dilophus vulgaris*, Mg.

Morgenthaler (D.). **The Victory over the Mite.**—*Bee Wld.*, xiii, no. 1, pp. 7–10. Camberley, Surrey, January 1932. (Translation from *Schweiz. Bienenztg.*, no. 10, 1931.)

Experiments are described that were undertaken in Switzerland during 1928–30 in numerous apiaries to determine the value of Frow's mixture [*R.A.E.*, A, xx, 63] for the control of acarine disease of bees. The fact that the most satisfactory results obtained were confirmed in the laboratory proves the excellence of this remedy in killing all stages of the mite [*Acarapis woodi*, Rennie] in the tracheae of the living bee. Its eradication in whole districts and countries is now only a matter of organisation.

For a colony of 8 or 9 frames in the Swiss hive (roughly equivalent to one holding 15 British Deep Standard frames), a dosage of 2 cc. dropped on to a pad under the frames and applied on 7 successive evenings is sufficient; for smaller colonies the dosage should be reduced. The method of applying 5 cc. twice with two days' interval, followed in the Dadant hives in French Switzerland, has the advantage that both treatments may be given by the inspector. In both cases the pad of felt or cardboard remains in the hives for 10 days. To avoid robbing and not to endanger the brood, the treatment should take place as late as possible in autumn. Frow recommends that it should be begun immediately after a good cleansing flight. This year in French Switzerland it was left till January with no bad results. The bees should have sufficient space to be able to move away from the fumes. The result of treatment can only be ascertained by examination

of bees of the new generation in the summer or autumn, when infestation is generally heaviest. Examples are given of the successful use of this method in the field.

Experiments in the laboratory with methyl salicylate (oil of wintergreen) were encouraging; with its use, robbing apparently does not occur and the brood does not suffer. It should be used similarly to Frow's mixture. Good results were also obtained with sulphur fumes, but it is difficult to arrive at the correct dosage.

[Golovyanko (Z. S.).] **Головянко (З. С.). Results of the Application of Paradichlorobenzene against the Larvae of the Forest Cockchafer, *Melolontha hippocastani* Fabr.** [*In Russian.*]—62 pp., 9 figs., 20 refs. Leningrad, Vsesoyuzn. nauchno-issled. Inst. lesn. Khoz. lesn. Promuishl. [All-Union Inst. Sci. Res. For. & For. Ind.] [?1930.] (With a Summary in English.) [Recd. December 1931.]

A detailed account is given of experiments with paradichlorobenzene against the larvae of *Melolontha hippocastani*, F., carried out in June 1929 in cleared areas in a pine forest near Kiev. Of the Lamellicorns in the soil 67 per cent. were *M. hippocastani*, of which 72 per cent. were mature. About 67 per cent. of all the larvae of *M. hippocastani* occurred immediately under the turf to a depth of about 4 ins., and a further 25 per cent. at a depth of 4–8 ins. Compared with the sands of the Lower Dnieper [*cf. R.A.E.*, A, xvi, 293; xvii, 306], the soil was finer, moister, less porous and colder, and the method of fumigation was therefore somewhat modified. The fumigant was applied in square holes made by cutting out about 40 sq. ins. of turf to a depth of 4 ins. Examination in September showed that all the larvae of *M. hippocastani* and other Lamellicorns were killed when the fumigant was placed in holes 14 ins. apart (the line of holes being also 14 ins. apart) at the rate of about $\frac{1}{4}$ oz. to each hole, irrespective of whether it was evenly distributed at the bottom of the holes to secure a better diffusion of the gas, or placed in a heap, and whether the holes were subsequently covered with turf or with friable soil only. In other plots, where the distance between the holes and the rows was increased to 21 ins., the mortality varied from 95·7 to 62·3 per cent., the lowest rates occurring when the paradichlorobenzene was placed in a heap and the holes were not covered with turf. Distributing the fumigant evenly at the bottom of the hole and covering with turf increased the mortality of *M. hippocastani* by 17 and 11·4 per cent. respectively in one instance, and by 22 and 16·3 per cent. in another. Remains of paradichlorobenzene amounting to 0·08 oz. were found in a number of holes, chiefly in the shaded part of the plots, when $\frac{1}{4}$ oz. had been placed in each hole, whereas it had completely evaporated where only $\frac{1}{8}$ oz. had been loosely scattered at the bottom. As a mortality of 90·8 per cent. was obtained in the latter case with holes 14 ins. apart, this being a higher rate than in some of the plots treated with doses of $\frac{1}{4}$ oz. in holes 21 ins. apart, it is clear that the application of smaller dosages at smaller intervals is preferable to the use of increased quantities sparsely distributed.

Special attention was devoted to the effect of paradichlorobenzene fumes on pine trees. Experiments, in applying various doses on one or both sides of rows of young trees, showed that even those only one

year old are not injured, provided that the fumigant is introduced into the soil at a distance of not less than $5\frac{1}{4}$ ins. from them.

Mechanical means for introducing paradichlorobenzene into the soil are discussed, and Kostenko's apparatus [xix, 110] and the corn-planter adapted by Jarvis [xvi, 378] are recommended.

[Zolotarev (E. Kh.).] **Золотарев (Е. Х.). On the Necessity for a Spring Survey of Egg-deposits of the Migratory Locust in Reed Beds.** [*In Russian.*]—*Plant Protection*, viii, no. 1, pp. 39–41, 1 ref. Leningrad, May 1931.

It is usual in the North Caucasus to confirm, in the spring, the results of the autumn survey of the egg-deposits of the migratory locust [*Locusta migratoria*, L.]. This second survey, however, only adds to the expense and is superfluous if the work has been thoroughly done in the autumn.

[Nevinnuikh (V. A.) & Ryabov (M. A.).] **Невинных (В. А). и Рябов (М. А.). On the Injury caused to the growing Point and on the Shedding of Buds and Ovaries in Kenaf** (*Hibiscus cannabinus*). [*In Russian.*]—*Plant Protection*, viii, no. 1, pp. 43–66, 8 figs., 4 refs. Leningrad, May 1931. (With a Summary in English.)

An account is given of observations in Daghestan during 1926–29 on insect injury to the growing point of the main stem of *Hibiscus cannabinus*. The percentage of damaged plants increased from 5–28 in 1927 to an average of about 40 in 1929, most of them being injured between June and August. They usually become stunted, thick stemmed and branched and yield less fibre. Very young plants with only 2–3 true leaves are sometimes killed. Field and laboratory observations in 1929 showed that the insects responsible are the Capsids, *Lygus pratensis*, L., and *Poeciloscytus cognatus*, Fieb., which also caused the shedding of the flower buds and ovaries. In some instances the growing tip was destroyed by *Laphygma exigua*, Hb. In the laboratory the shedding of buds and ovaries caused by *L. pratensis* was more than three times the normal in uninfested plants.

The adults of *P. cognatus* appeared at the end of May on weeds, and at the beginning of June congregated on young flowering shoots of field peas (*Pisum arvense*), and to a less extent on cotton and *H. cannabinus*. At the beginning of July, the nymphs were abundant on hairy vetch (*Vicia hirsuta*) and broad beans (*V. faba*), whereas adults still occurred on *H. cannabinus*, causing the leaves to become deformed. At the end of July, young adults migrated from *Vicia* partly to cotton but chiefly to *H. cannabinus*, on which the second generation developed till the end of August, the adults and nymphs infesting the tips of the main stem and side shoots. Only a few nymphs occurred on the plants at the end of the month, and none were found at the beginning of September.

Adults of *L. pratensis* were numerous on flowering broad beans at the end of June and throughout July, the nymphs occurring from about 10th July till the beginning of August. In late July young adults were found on cotton and *H. cannabinus*, and nymphs of all instars were abundant in August. Both the adults and nymphs, however, practically disappeared from the plants in the course of

September, whereas on cotton they were found as late as mid-October. On *H. cannabinus*, the nymphs attacked the small buds at the top part of the plants, and the adults the buds and young ovaries. In the autumn the adults were found on *Chenopodium album* and *Atriplex*. Hibernation probably occurs in the egg stage.

In field experiments, it was found that densely sown plants and those sown early were considerably less infested. Though quickly maturing varieties were less attacked, they are smaller and yield less fibre.

[Chugunin (Ya. V.).] **Чугунин (Я. В.). Comparative Infestation of different Varieties of Apple and Pear Trees by** *Cydia* (*Carpocapsa*) *pomonella* **L.** [*In Russian.*]—*Plant Protection*, viii, no. 1, pp. 67–86, 8 refs. Leningrad, May 1931. (With a Summary in English.)

Investigations were carried out in 1930 in the Southern Crimea, in continuation of previous work on the factors responsible for the uneven distribution of *Cydia pomonella*, L., in orchards [*R.A.E.*, A, xix, 407]. Examination showed that the rate of infestation of single trees depends on the amount of light the crown receives, its density and size, and the fruit-bearing capacity of the tree. The moths chiefly oviposit on the outer leaves of the top and middle of the crown, irrespective of its exposure to light or shade, but the larvae crawl in search of food to parts exposed to the sun, and laboratory experiments have shown that they can cover considerable distances. As the females fly high, the tallest trees are more infested.

The relation between the amount of fruit on a tree and the severity of infestation is discussed. It was found that the rate of infestation of both apples and pears by first generation larvae was inversely proportionate to the number of fruits, the absolute number attacked being higher on trees with fewer fruits. In the case of the second generation larvae, the absolute number of infested fruits was less in trees that bore fewer fruits, though the percentage of damaged fruit was still much higher. This may indicate some tendency for second generation eggs to be laid on fruit-bearing trees, and some are probably laid on the fruit itself. Of trees growing under similar conditions, those having a larger and more spreading crown are more severely infested, though the total number of fruits may be higher than in trees with medium sized or small crowns. Varieties of apples and pears that produce large fruits are more subject to infestation.

On the basis of these investigations the author concludes that well cultivated orchards with widely separated trees offer far more favourable conditions for the breeding of the moth than neglected ones.

[Rodendorf (B. B.).] **Родендорф (Б. Б.). A Tachinid Fly bred from the Pupae of** *Laphygma exigua* **Hübn., a Cotton Pest in Turkmenia.** [*In Russian.*]—*Plant Protection*, viii, no. 1, pp. 87–92, 5 figs. Leningrad, May 1931. (With a Summary in German.)

Detailed descriptions are given of the male, female, mouth-parts of the second and third instar larvae, and puparium of the Tachinid, *Prosopaea deserticola*, sp.n., reared in July 1930 from pupae of the Noctuid, *Laphygma exigua*, Hb., in the environs of Merv (south-eastern Turkmenistan).

[Safronova (N. E.) & Legatov (V. V.).] **Сафронова (Н. Е.) и Легатов (В. В.). Materials for the Study of the Wireworm in the north-eastern Part of the Central Black Soil Region.** [*In Russian.*] —*Provolochn. Tz. Ch.O.* [*Wireworms of the Centr. Black Soil Region*], pp. 1–32. Voronezh, Obl. SZR. [Region. Sta. Pl. Prot.], 1930. (Abstract in *Plant Protection*, viii, no. 1, pp. 107–108. Leningrad, May 1931.)

An account is given of observations on various Elaterids in the Tambov Government during 1926–28, the biology and ecology of the four predominant species, *Agriotes lineatus*, L., *A. sputator*, L., *Corymbites* (*Selatosomus*) *latus*, F., and *Melanotus brunnipes*, Germ., being discussed in detail. It was found that eggs were laid almost exclusively in hard or compact soils, *M. brunnipes* preferring fields of winter rye and the other species fallows and the edges of the fields. The life-cycle is completed in five years, four of which are spent by the larvae in the soil. The first moult takes place, not in the second year, as has been stated in the literature, but within about two weeks of hatching, further moults occurring once a year between June and September. Considerable damage was caused to millet, although this crop is usually considered to be only slightly attacked.

[Kovalev (N. V.).] **Ковалев (Н. В.). The Methods of chemical Control and their Outlooks.** [*In Russian.*]—*Plant Protection*, viii, no. 1, pp. 5–20.

[Petrov (A. D.).] **Петров (А. Д.). Present State of the Methods of Application of Contact Insecticides.** [*In Russian.*]—*T.c.*, no. 2, pp. 127–134. Leningrad, May–July 1931.

These papers review the research work carried out in recent years in the Russian Union on the control of pests by insecticides.

[Dodonov (B. A.).] **Додонов (Б. А.). On the Methods of the Field Testing of Insecticides and Fungicides.** [*In Russian.*]—*Plant Protection*, viii, no. 2, pp. 135–148, 3 diag., 1 ref. Leningrad, July 1931. (With a Summary in English.)

The value of experiments with insecticides depends on the possibility of verifying the results obtained and comparing them with those of other tests. This necessitates uniformity in the methods of investigation. The author therefore suggests some principles that would serve as a basis for field tests, with notes on the technique of the experiments. The insecticidal value of a preparation should always be first tested in the laboratory and then in a plot experiment to determine its value under the complex of natural environmental factors, the influence of which should be carefully studied. Large scale experiments represent only a verification of these tests to ascertain the practical value of an insecticide. Points that have to be considered in using dusting or spraying equipment to ensure the even application of a definite quantity of insecticide over a given area are discussed in some detail.

[Korotkov (V.).] **Коротков (В.). The methodical Principles of aviochemical Field-experiment.** [*In Russian.*]—*Plant Protection*, viii, no. 2, pp. 149–153. Leningrad, July 1931.

Information is given concerning the technical points in experiments on the application of insecticides by means of aeroplanes, such as the choice of suitable plots, the regulation of the release of the dust, etc.

In studying the evenness of distribution of dust over the treated area, it should be released on at least six parallel lines in each experiment, so that the dusted strips overlap, as with a single cloud, the bulk of the poison concentrates along the centre of the dusted strip. The width of the toxic strip is determined by comparing the percentages of insects killed in cages placed at intervals in the treated area. The distribution of the dust is found by comparing the amounts of dust settling on distilled water in dishes placed at intervals of about 16 ft., and its adhesiveness by removing all the leaves from the treated plants in a certain area, and comparing the quantity of the poison obtained from them with that collected from a flat surface of equal size. The damage caused to plants by the insecticide is determined by examining appropriate samples 5–10 days after dusting.

[Rafes (P. M.).] **Рафес (П. М.). Tactics and Strategy of Locust Control.** [*In Russian.*]—*Plant Protection*, viii, no. 2, pp. 161–166, 4 refs. Leningrad, July 1931.

A campaign against locusts in the hopper stage may be conveniently divided into two periods. During the first, there are numerous large bands of hoppers, not widely separated from each other; during the second, when the larger groups have been destroyed, the remaining hoppers form small and widely scattered bands. During the first period it is more economical to apply insecticides over large continuous areas, whereas during the second they should be applied to individual bands. Apparatus that can deal with large areas, such as horse-drawn sprayers or aeroplane dusters, are therefore more suitable in the first period, whereas during the second, their use results in a waste of insecticide, and knapsack sprayers are more economical. Poison baits are suitable for the first period only; during the second, when relatively small rapidly moving bands of hoppers are dealt with, other methods, such as trenches and barriers, are advantageous.

[Umrikhin (D.).] **Умрихин (Д.). The Beet Army Worm and the Cotton Bollworm in the Tadzhik S.S.R. and a new Method of their Control.** [*In Russian.*]—*Plant Protection*, viii, no. 2, pp. 171–175, 1 ref. Leningrad, July 1931.

A severe outbreak of the army-worm [*Laphygma exigua*, Hb.] and, later in the season, of the bollworm [*Heliothis obsoleta*, F.] occurred on cotton in Tadzhikistan in 1930. Against the former a poison bait, made by mixing 320 lb. cotton oilcake with 18 gals. water containing 15 lb. sodium arsenate, Paris green, or white arsenic, was broadcast in the infested fields. Careful examination 12 and 24 hours after application showed that 50 and 100 per cent. of the larvae respectively were killed. Flooding the fields 3–4 days after the application of the bait markedly stimulated the growth of the plants, which recovered from the injury caused.

For the control of the bollworm, the bait was applied chiefly to the plants themselves, as the larvae rarely descend to the ground. In order that it should remain moist, it was broadcast late in the evening or during the night. Examination 15 hours after treatment showed a mortality of 77·2 per cent.

[Esterberg (L. K.).] **Эстерберг (Л. К.). On the Mass Increase of *Dizygomyza lateralis* Mg. in the Year 1929.** [*In Russian.*]—*Plant Protection*, viii, no. 2, pp. 187–189. Leningrad, July 1931.

In the summer of 1929 an outbreak of the Agromyzid, *Dizygomyza lateralis*, Macq., occurred in many districts of the Government of Nizhnil-Novgorod, the larvae mining in the leaves of barley and summer wheat and causing the plants to wither. Examination of wheat fields in one of the localities showed that 82·5 per cent. of the plants were infested, 34·4 per cent. of the total number of the leaves on them being damaged. Each infested leaf harboured 2–3 larvae or pupae of the fly. Pupation, which took place in the mines, started on 6th June. In the insectary, the emergence of flies from pupae collected in the field occurred at intervals from 17th July till 11th August. About 31 per cent. of the material was parasitised by Hymenoptera. In spite of this outbreak, the fly was not recorded from this Government in the following year.

[Potapov (A. N.).] **Потапов (А. Н.). Control of Asiatic Locust by Aeroplane Dusting in Daghestan in 1930.** [*In Russian.*]—*Bull. Inst. Controlling Pests & Diseases*, no. 1, pp. 9–24, 4 figs. Leningrad, 1931.

This is a brief report on the organisation of a campaign against *Locusta migratoria*, L., in which six aeroplanes were used for dusting. An area of about 80,000 acres was treated, about $2\frac{1}{4}$ lb. dust being used per acre. The aeroplanes made 533 flights, and the actual flying time was $177\frac{1}{3}$ hours during 56 working days. Calcium arsenite was used alone, or mixed with Paris green. The latter is less effective when used alone.

[Isaev (S. I.).] **Исаев (С. И.). Insects injurious to Onion in the Rostov District. I.** [*In Russian.*]—*Bull. Inst. Controlling Pests & Diseases*, no. 1, pp. 25–53, 40 figs. Leningrad, 1931.

A list is given of the insect pests of onion observed between 1927 and 1930, inclusive, in the Rostov district of the Yaroslav Government, arranged under their orders and families, with notes on the bionomics of the more important ones, *viz.*, *Hylemyia antiqua*, Mg., *Muscina stabulans*, Fall., *Eumerus strigatus*, Fall., and the Nitidulid, *Glischrochilus* (*Librodor*) *hortensis*, Fourcr., infesting the bulbs; *Ceuthorrhynchus jacovlevi*, Schulze, and *Acrolepia assectella*, Zell., which damage the leaves, stems and inflorescences; *Dizygomyza cepae*, Her., *Barathra brassicae*, L., *Hydrellia griseola*, Fall., *Lilioceris merdigera*, L., and *Trioza* sp. (? *brassicae*, Vas.), which attack the leaves; and *Rhizoglyphus hyacinthi*, Banks, *Sciara* sp., and *Drosophila funebris*, F., which feed on the stored onions. *Muscina stabulans*, which has been thought only to attack damaged or decaying onions, was found to infest healthy ones. *Glischrochilus hortensis* and *Dizygomyza cepae* have not previously been recorded as onion pests in the Russian literature. The eggs,

larvae and pupae of the latter are briefly described. The eggs are laid in the tips of the leaves, in which the larvae mine, and pupation occurs in the soil.

Keys are given for the determination of these pests in the stage in which they attack the plants, based on the injury caused and on the morphological characters of the larvae, eggs and pupae.

[Zorin (P. V.).] **Зорин (П.В.). Guelder Rose Leaf-beetle** (*Galerucella viburni* **Payk.).** [*In Russian.*]—*Bull. Inst. Controlling Pests & Diseases*, no. 1, pp. 55–79, 21 figs., 8 refs. Leningrad, 1931.

A detailed account is given of the bionomics of *Galerucella viburni*, Payk., based on the literature and observations carried out in 1922–29 in and near Leningrad, where it caused severe damage to *Viburnum opulus* and *V. lantana*, which are extensively cultivated in public gardens as ornamental plants. All stages of this Galerucid are described. It has one generation a year. The larvae hatch from the overwintered eggs in the second half of May and beginning of June and attack the lower surface of the leaves, which they skeletonise. At 16–19° C. [60·8–66·2° F.] they matured in 16–21 days and then entered the soil for pupation. In the laboratory at this temperature, the life-cycle from hatching to adult emergence averaged about 6½ weeks, as compared with 8–13 weeks in the field. As the larvae enter the soil more or less simultaneously, there is a period of 3–4 weeks every summer when the plants are free from infestation. The adults also feed on the leaves of *Viburnum* and oviposit from August to October. The eggs are laid in a line of cavities made by the female in one- or two-year-old branches and closed with frass. Branches on which a long chain of punctures has been made usually become dry.

Cold and wet summers limit the increase of the beetle, which is also held in check by a number of Hymenopterous parasites. The eggs are attacked by *Tetrastichus* sp., the mature larvae by a Eulophid, *Closterocerus* sp., and the adults by a Braconid of the genus *Leiophron*. In the laboratory, the larvae were readily parasitised by the Tachinid, *Meigenia bisignata*, Mg. For control, infested branches should be removed in spring before the eggs hatch. The larvae may be killed by an application of tobacco dust, and larvae and pupae in the soil may be destroyed by digging over the ground, which should then be rammed down to prevent the emergence of adults. The latter may be jarred off the bushes and collected on sheets.

[Kozhanchikov (I. V.).] **Кожанчиков (И. В.). A Contribution to the Biology and Morphology of** *Erythroneura parvula* **Boh. (Typhlocybinae, Jassidae) injurious to Vinestock in Azerbaidzhan.** [*In Russian.*]—*Bull. Inst. Controlling Pests & Diseases*, no. 1, pp. 85–99, 2 figs., 2 refs. Leningrad, 1931.

This account of observations on *Erythroneura parvula*, Boh., carried out in 1926–28 in Azerbaijan, where it is a serious pest of vines, is preceded by brief notes on the biology and geographical distribution of the species of the subfamily Typhlocybinae, with keys to the genera and to the species of *Erythroneura*. The morphology of all the stages of *E. parvula* is described. In Azerbaijan there are three overlapping generations a year, the adults of the third hibernating under débris on the soil and in buildings near the vineyards. They appear early in

the spring and at once attack young vine shoots or weeds that have survived the winter ; they also feed during the winter if the weather is warm. Pairing and oviposition only occur after a period of maturation feeding that lasts over a month in the case of overwintered adults, and 15–17 and 18–25 days for young adults of the first and second generations respectively. The overwintered Jassids lay their eggs in late April and the first half of May, chiefly on grasses and shrubs, though a few may be deposited on the leaves of vines, singly under the epidermis of the lower surface and usually along the veins. The nymphs of the first generation develop chiefly on weeds, but the adults of all generations and the nymphs of the second and third show a definite preference for vines. The egg stage lasts 7–15 days, depending on the temperature, and the nymphal, which comprises five instars, 22–33. The nymphs always occur on the lower surface of the leaves, and the older ones readily migrate from one leaf to another, varieties of vine that are only slightly pubescent being preferred. The eggs of the second generation occurred in the second half of June, and the adults appeared in the second half of July, oviposition taking place in the first half of August and the third generation adults appearing at the end of September. The infested leaves become covered with yellow or red spots in places where the Jassids have made punctures, then dry up and fall off, the exposed bunches of grapes gradually withering. As a result of the decrease of the assimilative surface of the foliage, the grapes lose much of their sugar content and become sour, and the plants are weakened and often killed by subsequent frost.

Control measures are briefly discussed. Spraying the vines destroys the second and third generation nymphs, but the adults are easily disturbed and fly away before the spray strikes them. A decoction of 1–2 lb. of low-grade leaf tobacco to 24 gals. water gives 80–90 per cent. mortality if it is applied two or three times and the vines are well wetted, at least one pint of spray being used to each plant. Though excellent results were also obtained with oil emulsions, the cost of labour and machinery involved in their preparation prohibits their use. In glasshouses the Jassids may be completely controlled by fumigation with hydrocyanic acid gas or tobacco smoke.

[Zakharov (P.).] **Захаров (П.). The Experiment of Aeroplane Dusting in the Control of** *Bupalus piniarius* **L. in the Forests of the Central Russia Region and Ukraine in 1930.** [*In Russian.*]—*Bull. Inst. Controlling Pests & Diseases*, no. 1, pp. 121–126, 1 fig. Leningrad, 1931.

In 1929 and 1930 serious injury was caused to pines 30–35 years old in some forests of the Central Black Soil Zone and the Ukraine by *Bupalus piniarius*, L., as many as 3,000 larvae occurring on some of the trees. Aeroplane dusting with calcium arsenite was carried out in the second half of September 1930, an area of nearly 2,000 acres being treated. The percentage of larvae killed was calculated by cutting off all the branches from certain trees 6–7 days after dusting and counting the dead and live individuals present on them and those that had fallen to the ground, or by collecting the excreta of the larvae before and after the dusting. Collection of excreta showed that in cold weather the larvae eat 5–10 times less than when it is warm.

The work is best carried out on calm days and early in the morning, when a descending air current forces the insecticide towards the earth.

Most of the larvae died within 6 or 7 days after dusting. On an average, 60–70 per cent. were killed, but the mortality reached 90–100 per cent. when 9–10 lb. calcium arsenite were used to the acre. The dosage should be varied according to the height and density of the vegetation, larger quantities being required where the trees are close together. The rate of mortality was lower in places where the infestation was less severe, the number of the larvae to a tree not exceeding 100–120, probably because individuals could select needles that had remained free from dust. If the weather is suitable, aeroplane dusting can still be carried out in September, but October would be too late.

[Naumov] Naoumoff (N. A.). **Results of the Investigation of the fungal Diseases of Locusts,** *Schistocerca gregaria,* **in Central Asia during the Summer of 1929.** [*In Russian.*]—*Mater. Mycol. Phytopath.*, viii, no. 2, pp. 115–124. Leningrad, 1931. (Abstract in *Rev. Appl. Mycol.*, xi, pt. 1, p. 42. Kew, Surrey, January 1932.)

An investigation of the high mortality observed in the summer of 1929 among the migratory and local populations of *Schistocerca gregaria,* Forsk., in Russian Central Asia, showed definitely that the cause was due either to a parasitic fly, the larvae of which were invariably present in all the dead individuals and in most of the living ones examined, or to a poison bait that had been used during the spring. Various fungi occurred on both living and dead locusts, but the mycelium was not found in the internal tissues or cavities, and none was capable of penetrating living or dead tissue even under optimum conditions.

Ping (C.). **Preliminary Notes on the Fauna of Nanking.**—*Contr. Biol. Lab. Sci. Soc. China* (Zool.), vii, no. 4, pp. 173–201, 9 refs. Nanking, China, 1931.

Three pages of these notes deal with insects, of which the most injurious is *Locusta migratoria,* L., which every year causes immense damage to crops in the Yangtsze valley. Other serious pests are the rice borers, *Chilo simplex,* Butl., and *Schoenobius bipunctifer,* Wlk. (*incertellus,* Wlk.), *Earias chromataria,* Wlk., on cotton, *Aphis gossypii,* Glov., *Bombyx mandarina,* Moore (mulberry moth) and termites.

Kunhi Kannan (K.). **The Mass Rearing of the Egg Parasites of the Sugarcane Moth Borer in Mysore. (Preliminary Experiments.)**—*J. Mysore Agric. Exptl. Un.*, xii, no. 2, pp. 57–61. Bangalore, 1931.

An attempt is being made in Mysore to replace the trash trap method of controlling the sugar-cane moth borers [*R.A.E.*, A, xii, 381] by biological control by means of the egg parasite, *Trichogramma* sp. This parasite is indigenous in Mysore, but is not normally sufficiently numerous to be effective. For laboratory rearing, eggs of *Sitotroga cerealella,* Ol., did not appear to be large enough, and those of the rice webworm moth were therefore used instead. One generation of the parasite is reared in 6–11 days, and in these preliminary experiments 32 generations have been bred. The method employed is much simpler than that used in the United States. Into the tin rearing cylinder a roll of a strip of corrugated packing paper 1 in. wide is placed so as to fit closely into the surface of the grain. The larvae work their way up to the surface for pupation and enter the spaces in the corrugated paper for that purpose. The roll is then taken out and fitted to the

mouth of a small cylinder upside down, so that the heads of the pupae are directed downwards and the moths on emergence will fly into the cylinder. There they pair and drop their eggs through the wire gauze bottom of the cylinder into a funnel fitted below. The eggs are collected and placed on cards brushed over with mucilage from cactus, which is cheap and very effective. The cards are placed in petri dishes and the parasites introduced, and when the eggs have been parasitised, the dishes are placed in a refrigerator to delay development until they are required. In the laboratory, the parasites have also been reared on the eggs of *Euxoa* sp., *Heliothis obsoleta*, F., *Amsacta albistriga*, Wlk., *Diacrisia obliqua*, Wlk., *Laphygma exigua*, Hb., and *Adisura atkinsoni*, Moore, and it is hoped that they may attack these hosts in the field. In the case of *D. obliqua* it was found that several parasites emerged with ill-developed wings. When this mass rearing has been organised, parasite cards are to be distributed as soon as the cane has sprouted and small pieces pinned to the leaves throughout the field.

Report on the Work of the Plant Inspectorate.—*Adm. Rep. Dir. Agric. Ceylon, 1930*, pp. D57–64. Colombo, October 1931.

Brief notes are given on the pests and diseases recorded from the central, southern and north-western districts of Ceylon [*cf. R.A.E.*, A, xviii, 559]. C. N. E. J. de Mel reports that in the central division the Aphid, *Pentalonia nigronervosa*, Coq., was found on bananas (*Musa sapientum* and *M. paradisiaca*), Manila hemp (*M. textilis*), *M. coccinea*, *Ravenala madagascariensis* and *Strelitzia* sp. Symptoms of bunchy top disease [xix, 62] were confined to the economic species of *Musa*. *Acrocercops ordinatella*, Meyr., on avocado pear (*Persea gratissima*) is recorded from this food-plant for the first time. S. J. F. Dias reports that in the southern division breadfruit [*Artocarpus incisa*] was considerably damaged by *Batocera rubus*, L. (rubber root borer) for the first time in Ceylon.

Benson (R. B.). **Sawfly Notes. II. Parallel Variation in** *Athalia lugens* **Kl. and** *Athalia cordata* **Lep. (Hymenoptera Symphyta).**—*Ann. Mag. Nat. Hist.*, (10) ix, no. 50, pp. 183–188, 2 figs., 5 refs. London, February 1932.

In the course of these notes, it is pointed out that the sawfly infesting crucifers in Formosa is *Athalia lugens proxima*, Klug, and not *A. japonica*, Klug, which occurs on the same plants in Japan [*R.A.E.*, A, xvi, 360].

Arrow (G. J.). **A few new Species of Melolonthine Coleoptera.**—*Ann. Mag. Nat. Hist.*, (10) ix, no. 50, pp. 189–197. London, February 1932.

Among the new species dealt with are *Idaecamenta eugeniae*, the larvae of which are destructive to roots of the clove tree (*Eugenia caryophyllata*) in Zanzibar, *Lepidiota laevis*, which swarms in great numbers in the Atherton Tableland, Queensland, the larvae causing serious injury to pastures, *Idionycha* (gen. n.) *excisa*, which defoliates trees at Dehra Dun, and has also been found in the soil at the foot of a mango tree at Pusa, India, and *Anodontonyx noxius* (wheat root grub), the larva of which attacks wheat and oats in New South Wales. The last-named has been erroneously recorded as *A. tetricus*, Blkb. [*R.A.E.*, A, xvi, 347, 532].

Atherton (D. O.). **Grass Pests of the Atherton Tableland.**—*Queensland Agric. J.*, xxxvi, pt. 5, pp. 474–481, 4 refs. Brisbane, 1st November 1931.

The insects injurious to pastures on the Atherton Tableland, Queensland, include *Lepidiota caudata*, Blackb., and an undetermined species [? *L. laevis*, Arrow (see preceding paper)], which feed on the roots, and the Hepialid, *Oncopera mitocera*, Turner, which attacks the parts of the grass above the soil. Damage by *L. caudata* is usually observed during the autumn and winter, the grass dying in roughly circular patches. In heavy infestations, these patches extend over practically the entire field. As many as 146 larvae have been taken at a depth of less than 6 ins. over 1 sq. yd. The adults are on the wing in summer during the early weeks of the wet season and apparently oviposit in isolated places, for outbreaks usually commence at various centres in a given area of grass. Unless the numbers are considerable, no damage is apparent until the second year of larval life. The larval stage is completed in September of the second year, and the pupal period lasts two or three months. Attacks by Lamellicorn larvae appear to be confined to the older pastures; all infestations of *L. caudata* have been in pastures of about 15 years' standing. In some cases those seriously infested have recovered even though subjected to heavy grazing, but there is evidence that beneficial results may be obtained when the fields are not used for grazing for a time. Heavy rains destroy the grubs in certain low-lying areas, and good winter rains are indirectly beneficial in helping the pastures to outgrow the injury. In localities where cultural methods are feasible they should be carried out in November and December. Allowing pigs to feed on infested land is also recommended.

O. mitocera [*cf. R.A.E.*, A, ix, 566] has been taken from pastures of 6–18 years' standing, infestation being apparently closely related to the proximity of farm lands and unfelled rain forests.

Veitch (R.). **The Leaf-eating Ladybird.**—*Queensland Agric. J.*, xxxvi, pt. 5, pp. 482–484, 6 figs. Brisbane, 1st November 1931.

The information contained in this paper on the Coccinellid, *Epilachna vigintioctopunctata*, F., attacking vegetables in Queensland is an extract from a previous publication [*R.A.E.*, A, xvii, 458; *cf.* also xvi, 631].

Jarvis (H.). **Experiments with a new Fruit Fly Lure.**—*Queensland Agric. J.*, xxxvi, pt. 5, pp. 485–491. Brisbane, 1st November 1931.

An account is given of experiments in Queensland during 1929–30 and 1930–31 to compare the efficiency of the Jarvis bait [see next paper] with that of the Harvey bait against *Dacus ferrugineus*, F. (*Chaetodacus tryoni*, Frogg.). Glass bowls containing approximately 6 oz. of the bait were hung in two separate orchards consisting of about 20 acres of pomaceous and stone fruits of early and late maturing varieties. They were refilled as required; in normal summer weather this was generally once a week. Though the period was not favourable for obtaining conclusive results as to the value of baits for the control of this pest, the Jarvis bait was found to be as satisfactory as the Harvey bait, and is cheap, efficient and easily manufactured. Details of the cost and quantities of both baits used in the experiment are given.

VEITCH (R.). **Report of the Chief Entomologist.**—*Ann. Rep. Dept. Agric. Queensland, 1930–31*, pp. 43–46. Brisbane, 1931.

Some of the information in this report has already been noticed [*R.A.E.*, A, xix, 714]. A bait devised by H. Jarvis containing $\frac{1}{8}$ oz. imitation vanilla essence, $\frac{1}{2}$ oz. household ammonia and 26 oz. water proved successful in attracting both sexes of the following fruit flies: *Dacus ferrugineus*, F. (*Chaetodacus tryoni*, Frogg.), *Ceratitis capitata*, Wied., which though not established in Queensland is often imported in infested fruit, *D.* (*C.*) *dorsalis*, Hend., *D.* (*C.*) *jarvisi*, Tryon, *D. niger*, Tryon, and *Rioxa musae*, Frogg. As a result of field trials in 1929–30 and 1930–31, this bait can be recommended for use in deciduous fruit districts.

Damage to *Citrus* was caused by *D. ferrugineus* and *Dichocrocis punctiferalis*, Guen., which also attacked custard apples [*Anona*] but to a less extent, the fruit-piercing moth, *Othreis fullonica*, L., and the Pentatomid, *Nezara viridula*, L., which is well known as a pest of vegetables. Experiments on soil fumigation against *Decilaus citriperda*, Tryon, indicate beneficial results from paradichlorobenzene. This weevil, which was generally thought to attack older *Citrus* trees, has been observed seriously damaging young ones.

Unsuccessful attempts were made to recover *Trichogramma minutum*, Riley, liberated in previous seasons against *Cydia pomonella*, L. (codling moth). Though in previous years *Aphelinus mali*, Hald., has exercised effective control over *Eriosoma lanigerum*, Hausm. (woolly apple aphis) in a number of cases, little benefit has been observed during the past season. The larvae of *Belus bidentatus*, Donovan, have been reported from two localities attacking the twigs of apple, but it is not thought that this weevil will become of any great importance. Its native food-plant is *Jacksonia scoparia*. *Dacus* (*Chaetodacus*) *musae*, Tryon, damaged bananas in the northern districts, and *Cosmopolites sordidus*, Germ., caused a marked reduction in the yield of this crop. The rate of progress of the introduced predator, *Plaesius javanus*, Er. [xix, 222] has not been rapid, and it is thought that several years may elapse before appreciable numbers may be observed.

Agromyza phaseoli, Coq. (bean fly) was unusually abundant during the winter months. *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.) occurred in large numbers during the winter on cabbage, and severe losses were experienced. The weevil, *Listroderes obliquus*, Gyll. (*Desiantha nociva*, Lea) is apparently increasing, being reported from various vegetables, strawberry and tobacco seedlings. Infestation by *Heliothis obsoleta*, F., a pest of tomatos, cotton and tobacco, was again severe. Repeated applications of arsenical sprays did not give satisfactory results, but a bait of molasses and water attracted large numbers of the moths. Damage by the Pyralid, *Psara* (*Botys*) *phaeopteralis*, Gn., to paspalum grass occurred in the autumn in the southern coastal districts. The attacks terminated as suddenly as they began, and control measures were not necessary.

PESCOTT (R. T. M.). **Codling Moth Control. Experiments at Harcourt.**—*J. Dept. Agric. Vict.*, xxix, pt. 11, pp. 538–543, 4 figs., 1 graph. Melbourne, November 1931.

As the result of experiments carried out in Victoria in 1930–31, the use of a programme similar to that recommended in the previous year is again advised for the control of *Cydia pomonella*, L., on apple

[*R.A.E.*, A, xix, 63]. No spreader is, however, included in the lead arsenate calyx sprays. Cover sprays of lead arsenate were again much less effective than oil sprays, which gave as good results at a strength of 1 in 60 as at 1 in 40. Reports have been received of the adverse effect of oil sprays on the size and quality of the fruit as compared with arsenicals, but in the author's experiments no significant difference in size was found, and the colour of the fruit was better on trees sprayed with oil.

Queensland. Seventh Annual Report of the Prickly-pear Land Commission, being for the Year ended 30th June, 1931.—Fol., 31 pp., 1 map. Brisbane, 1931.

Considerable progress has been made in the campaign for the eradication of prickly-pear (*Opuntia*) in Queensland [*R.A.E.*, A, xix, 573]. A total of 503,900,000 eggs of *Cactoblastis cactorum*, Berg, was distributed during the year, bringing the number since October 1927 up to 2,204,000,000 distributed either by the Commission or through material supplied to landowners. A survey showed that this Pyralid is established practically throughout the affected area.

Following heavy rainfall in the winter of 1930, abundant new growth occurred in the spring and early summer, which, owing to the heavy mortality of *C. cactorum* from starvation in the previous year, was little affected by it or by the cochineal insect [*Dactylopius*], which had received a severe check from the winter rains. This secondary growth reached its maximum development in the middle of the summer, but *C. cactorum* now has it well under control in most districts. In some, however, there is considerable growth on which the moth is not concentrated in large numbers, and re-establishment of the latter may be necessary. A large quantity of *Dactylopius* sp. attacking the velvety tree-pear (*O. tomentosa*) was secured for liberation in certain areas in Central Queensland. The tiger-pear (*O. aurantiaca*), although not a pest of major importance, is spreading in certain localities despite the application of poison and the activities of *C. cactorum*, which only destroys the growth and not the underground butts and bulbs. This plant possesses remarkable powers of recovery, and no species of *Dactylopius* has been induced to live on it.

Corbett (G. H.). **Division of Entomology. Annual Report for the Year 1930.**—*Gen. Ser. Dept. Agric. S.S. & F.M.S.*, no. 6, pp. 48–64. Kuala Lumpur, 1931.

Many of the pests observed in Malaya during 1930 have already been noticed [*R.A.E.*, A, xviii, 509, 657; xix, 139, 295, 649]. The Braconid, *Spinaria spinator*, Guér., is recorded as sometimes parasitising *Setora nitens*, Wlk., during heavy infestations of that pest on coconuts. The leaves of coconuts were damaged by *Amathusia phidippus*, L., at the end of the year. *Stephanoderes* (*Cryphalus*) *hampei*, Ferr. (coffee berry borer) has extended its range. The weekly collections of berries advocated [xviii, 509, 657] was begun in April on two areas, but the results seem to suggest that where the attack is heavy, regular and frequent collection is not entirely satisfactory. An extensive survey of coffee areas in one region, however, showed this Scolytid to be most abundant in abandoned areas, less numerous where irregular collections were made and conspicuously less where

collections were frequent and regular. Other pests taken from coffee berries were the Anthribid, *Araecerus fasciculatus*, DeG., the Nitidulid, *Carpophilus dimidiatus*, F., a Mycetophagid, *Litargus* sp., and the Tineids, *Stathmopoda theoris*, Meyr., and *Blastobasis curta*, Meyr. The Cetoniid, *Protaetia fusca*, Hbst., has been bred from the refuse of coffee factories. The leaves of guttapercha [*Palaquium*] were damaged by the Pyralid, *Sylepta balteata*, F., and the Thyridid, *Rhodoneura* (*Brixia*) *myrtaea*, Dru. The Cicadid, *Dundubia intemerata*, Wlk., injured the twigs of various trees, including rubber, *Tephrosia candida*, cotton, tomato and many fruit trees.

Bodkin (G. E.). **The Palestine Locust Campaign 1930.**—28 pp., 1 map. [Jerusalem] 1931.

The invasion of Palestine by *Schistocerca gregaria*, Forsk., in 1929–30 was far greater than those of immediately preceding years [*R.A.E.*, A, xvii, 652] and was probably on the same scale as in 1915, with the difference that in that year the locusts bred mostly in the cultivated coastal areas, whereas in 1929–30 the majority settled in the vast desert region around and far to the south and south-west of Beersheba.

The first swarms appeared in the Jordan valley at the end of October 1929, and further ones followed later. From mid-December to the end of February 1930 large swarms were coming into Palestine in a succession of waves, invading mainly the southern districts. The Dead Sea area was again invaded by numerous large swarms early in March, but most of these were carried away to Syria by strong south-westerly winds. Oviposition occurred from February to the end of April, and hoppers began to hatch at the end of March. About mid-May, when the situation in southern Palestine had eased considerably, a sudden invasion by large bands of hoppers took place.

The anti-locust campaign was conducted from about mid-April to the end of June, and operations were greatly facilitated by the existence of an excellent system of roads, and by the use of the telephone and three small wireless stations located at strategic points, as well as of a travelling wireless set. The campaign was under the general control of the Government entomologist, three senior field officers being in charge of the three areas into which the country was divided; in addition eighty junior officers, each in charge of a mobile camp, were employed. Organisation of transport proved to be very troublesome, as it was impossible to foresee in making contracts the immensely varying conditions under which the work had to be carried out, and the experience suggests that in an intensive anti-locust campaign over wide areas it would be advisable for the Government to purchase and operate its own motor transport. The labour, animals and ploughs employed for the destruction of egg-deposits were obtained by conscription, while the work with zinc barriers and with poison baits was done in many cases by paid labour, a fact that had great influence on the success of the campaign. During the peak period nearly 12,000 men were employed. The expenses totalled about £27,000, of which about £11,000 represents the cost of materials and stock remaining at the end of the campaign.

As regards the actual control operations, it was found that thorough scouting for eggs by specially appointed individuals, although somewhat expensive, was fully justified by the results obtained. The demarcation of egg-infested areas is worth while only in those places in which the

nature of the land allows of ploughing or hoeing, and must be done carefully. Ploughing was found a very efficient method of control in many cases, but it should be done very thoroughly and repeated up to four times ; little effect was observed if it was only done once. Hoppers were controlled mainly by poison baits prepared according to the Sudan formula [xvii, 507], and over 200 tons of the bait were used, with excellent results. In many cases, however, zinc barriers proved more suitable, particularly for the protection of cultivated areas against immense advancing bands of hoppers. Flame-throwers were used, with success in some cases, particularly for exterminating resting swarms before oviposition. Spraying with mineral oils is of value under certain conditions provided that their cost is not too high.

The damage amounted to less than 1,000 acres of various crops destroyed by hoppers and over 200 acres of land already sown with cereals and ploughed up to destroy the eggs ; in the latter case compensation was paid.

The eggs were infested by the Calliphorid, *Stomatorrhina lunata*, F., particularly in moist ground, and the Tettigoniid, *Saga ephippigera*, F.-W., was observed preying on hoppers. Storks, while consuming large numbers of locusts, scatter the swarms so that the eggs are laid over a larger area.

The extensive use of poison baits in the Beersheba area caused attention to be devoted to the possibility of arsenic being washed out by winter rains and conveyed into cisterns used to conserve rain water collected from the catchment areas. Analyses of water from a number of cisterns were made in the winter following the campaign, but only in some cases were traces (less than 1 in 5 million) of arsenic found.

CHEVALIER (A.). **Sur l'extension et la propagation de la maladie de la rosette de l'arachide au Sénégal.**—*C.R. Acad. Sci. Fr.*, cxciii, no. 22, pp. 1115–1117. Paris, 1931.

The percentage of infection of ground-nuts [*Arachis hypogaea*] with rosette disease in Senegal was estimated to have increased from 1–2 in 1929 to 10–15 in 1930, though the disease appeared to be less prevalent in 1931. A variety of *Aphis laburni*, Kalt., already recorded as a vector of the disease in Uganda [*R.A.E.*, A, xvi, 314], is believed to be responsible in Senegal also. Experiments showed that healthy plants to which Aphids from diseased ones were transferred became infected. The ant, *Cremastogaster senegalensis*, Roger, was found associated with the Aphids, and the larvae of *Chilomenes* (*Cydonia*) *vicina*, Muls., destroyed large numbers of them. The disease is very prevalent on ground-nut plants that grow up on fallow land, which appear very early. These, and probably other leguminous plants, form a permanent focus of infection, the Aphid carrying the virus in August to the cultivated ground-nuts. Destruction of infected plants with the Aphids on them would be of considerable help in checking the spread of the disease.

Sierra Leone : Destruction of Locusts Ordinance, No. 21 of 1931.—4 pp. Freetown, 8th November 1931.

This ordinance empowers the Governor of Sierra Leone to declare areas within the Colony and Protectorate within which certain rules for the destruction of locusts shall apply, and to enforce such rules.

Owners or occupiers of land are made responsible for reporting the presence of ovipositing locusts, locust eggs or locust hoppers on their land and taking measures to destroy them. They are enjoined to afford locust officers every assistance in their work. Locust officers are empowered to undertake the necessary measures where such have been neglected by the owners or occupiers of land.

Rapport de la réunion internationale convoquée par le Ministère des Colonies d'Italie pour l'étude du problème des Acridiens migrateurs. —8 pp. Rome, 1931.

At the suggestion of the British Government, the Italian Government organised a meeting of experts at Rome in September 1931, to discuss methods for co-ordinating studies on migratory locusts in Africa and Western Asia. Representatives of the British Empire, France and its African possessions, and Italy were present. After a discussion of the problem of migrations and of the breeding areas of the desert locust (*Schistocerca gregaria*, Forsk.) and of the tropical migratory locust (*Locusta migratoria migratorioides*, R. & F.), the meeting decided that the discovery of permanent breeding areas and the study of ecological conditions prevailing in them must be considered an essential basis for the most effective and the most economical method of defence against locusts.

The meeting discussed and adopted a common questionnaire for collecting information on migrations and breeding of locusts, as well as a list of conventional signs to be used on maps showing locust movements, which are to be issued periodically by the Government of each country. These are reproduced in the appendix.

The meeting asked the Italian Ministry of the Colonies to forward to all the Governments interested in the locust problem their proposals for the organisation of unified research on locusts. One of these is the recognition of the Imperial Institute of Entomology in London as an international central institution for the collection, co-ordination and study of all biological data on locusts in Africa and Western Asia. In order to facilitate the work of the Institute, all the Governments should be invited to co-operate in it, and to form local centres for summarising the information in each country. Further co-ordination of local research will be best served by the organisation of annual meetings of specialists for discussion of results achieved and programmes for further investigations. The next meeting of this kind is to take place at Paris during the Fifth International Entomological Congress [in July 1932].

With regard to *Locusta migratoria migratorioides*, the meeting stressed the necessity of investigating in the immediate future the supposed breeding areas in the Timbuctoo region.

Delassus (M.). **The Presence of *Merodon geniculatus* in the Vicinity of Algiers.**—*Int. Bull. Plant Prot.*, v, no. 12, p. 213. Rome, December 1931.

Injury resulting in the destruction of numbers of bulbs of ornamental Amaryllidaceae, caused by the larvae of *Merodon geniculatus*, Strobl, was reported from the neighbourhood of Algiers on 7th March 1931,

when a few pupae were also found in the bulbs. In the insectary, emergence began on 14th April, reached its maximum between 20th and 25th April and ceased on 15th May ; maximum emergence from a further batch of bulbs received on 25th August occurred on 10th September. Steeping the bulbs in a decoction of derris proved ineffective. No parasite was discovered in the course of breeding experiments, but a number of saprophytic Diptera were found apparently living in the decaying tissues of the infested bulbs, including *Sciara* sp., *Helomyza variegata*, Lw., *Lonchaea splendida*, Lw., *Drosophila* spp., and *Scatopse* sp., as well as a Staphylinid, *Atheta pertyi*, Heer.

DE BENEDICTIS (A.). **Eritrea : Locusts** (*Locusta migratorioides* **and** *Schistocerca gregaria*).—*Int. Bull. Plant Prot.*, v, no. 12, pp. 214–215. Rome, December 1931.

Movements of *Locusta migratoria migratorioides*, Rch. & Frm., and *Schistocerca gregaria*, Forsk., in Eritrea during September and October 1931 are recorded. Neither the presence of eggs nor hatching of locusts was reported during September in the upland plateau or the eastern plain, but infestation of the territories of the western plain was somewhat serious, considerable damage to crops being reported there and in the territory of Cheren, where oviposition by a large swarm of *L. migratoria migratorioides* was observed on 2nd September in two localities and hatching of hoppers on 10th September in a third.

Numerous swarms of locusts were reported during October over the whole territory of the Colony, the greater number being composed of *L. migratoria migratorioides*. Swarms of *S. gregaria* coming from the Anglo-Egyptian Sudan penetrated into Eritrean territory on 1st, 9th and 15th October.

GREEN (E. E.). **A Note on** *Icerya aegyptiaca*, **Dougl. (Coccidae), and some nearly related Species.**—*Stylops*, i, pt. 2, pp. 31–33, 1 fig. London, 15th February 1932.

A study of the dermal pores of a series of *Icerya* that the author had referred to *I. aegyptiaca*, Dougl., revealed the fact that it included *I. zimmermanni*, sp. n. (described from Java) and *I. tangalla*, Green, which had been treated as a synonym of *I. aegyptiaca*. A further description is given of *I. jacobsoni*, Green, with a key to these four species.

BODENHEIMER (F. S.) & KLEIN (H. Z.). **Ueber die Temperaturabhängigkeiten von Insekten. II. Die Abhängigkeit der Aktivität bei der Ernteameise** *Messor semirufus* **E. André von Temperatur und anderen Faktoren.** [On the Influence of Temperature on Insects. II. The Dependence of Activity in the Harvester Ant, *M. semirufus*, on Temperature and other Factors.]—*Z. vergleich. Physiol.*, xi, no. 3, pp. 345–385, 17 diag. Berlin, 1930. [Recd. December 1931.]

A detailed account is given of the connection between external factors, particularly climate, and the ecology of the harvester ant, *Messor semirufus*, E. André, based on five years' observations in the

laboratory and the field in the coastal zone of Palestine. The results show that the ants are actively engaged in winter in carrying earth out of their nests, and at the end of spring and in summer in carrying in seeds of all kinds. The occurrence of the sexes and the nuptial flight immediately follow the winter rains. There are two peaks of activity during the year, in April and in December, and two depressions, in January–February and in August. Activity is interrupted from November to March at temperatures as low as 5–10° C. [41–50° F.] and in summer and autumn at temperatures of over 30° C. [86° F.]. No relation was observed between activity and rain, dew, moonlight or wind. The vital optimum for the workers is between 17 and 19° C. [62·6–66·2° F.], temperatures of 24° C. [75·2° F.] and over being tolerated for a short period only. The largest number of individuals are active at mid-day in winter, in the evening in spring, throughout the night in summer, and during the first half of the night in autumn. For each month the average speed of movement at different temperatures can be placed on a regular hyperbola, with an abscissa corresponding to zero activity. These zero points vary from 3·5° C. [38·3° F.] in April to 21·1° C. [69·98° F.] in September. This phenomenon, which must be due to physiological changes in the ants, is considered of great ecological importance.

Review of Agricultural Operations in India 1928–29.—Med. 8vo, v+ 251 pp., 13 pls., 1 map. Calcutta, Govt. India Cent. Pub. Br., 1931. Price 5*s.* 6*d.*

Very brief notes on insect pests are included in a chapter dealing with economic work on crops (pp. 13–78) and in a section on insect pests (pp. 92–93). Much of the information has previously been noticed [*R.A.E.*, A, xviii, 443, etc.].

Studies on the climatic factors affecting the pink bollworm [*Platyedra gossypiella*, Saund.] in the Punjab indicate that the principal source of infestation is larvae carried in the cotton seed. During April–June, one day's exposure of the seed to the sun proved sufficient to destroy all the larvae. In Gujerat, *Earias fabia*, Stoll, and *E. insulana*, Boisd. (spotted bollworms) are the cause of a good deal of shedding of bolls, rendering the main crop abnormally late ; the use of poison dust and mulching the soil are being tried as remedies. *Dysdercus cingulatus*, F. (red cotton bug), which at Lyallpur is absent when the cotton crop is a poor one, only thrives at temperatures between 70 and 95° F. and at humidities above 40 per cent. Observations showed that sugar-cane varieties with broad, soft leaves are preferred by *Pyrilla* ; the use of late-ripening canes and ratooning encourage this Lophopid, which migrates direct from the old to the new crop, though it also survives temporarily on cereals and wild grasses. Sudden variations in the incidence of mosaic disease of sugar-cane at Pusa in the absence of *Aphis maidis*, Fitch, suggests the occurrence of an unknown vector of the disease. Calcium cyanide gave complete control of red spider [*Tetranychus bioculatus*, W.-M.] on tea ; it was found that any pruning treatment that resulted in the retention of poor and old wood increased infestation and that heavy plucking had the same effect.

A section (pp. 93–95) deals with the cultivation of lac and the insect enemies of the lac insect [*Laccifer lacca*, Kerr] [*cf.* xix, 650, etc.].

Betrem (J. G.). **Voorloopige mededeeling over het smeren met bessenboeboeksmeer als voorbehoedmiddel tegen takkenboeboek.** [A preliminary Communication on Smearing with Coffee Berry Borer Grease as a Preventive against Twig-borers.]—*De Bergcultures*, v, p. 799, 25th July 1931. Also as *Korte Meded. Proefst. Malang*, no. 34, 6 pp., 1 fig. Malang, 1931.

Against coffee twig-borers [*Xyleborus* spp.] in Java, a trial was made of the method used against the coffee berry borer [*Stephanoderes hampei*, Ferr.], of smearing the twigs with a grease [*cf. R.A.E.*, A, xi, 169]. This was found to be an effective preventive measure and to be advisable where a serious infestation may be expected in young plants.

Easterby (H. T.). **Cane Grub—biological Control.**—*Queensland Agric. J.*, xxxvi, pt. 6, p. 542. Brisbane, 1st December 1931.

A consignment of the Tachinid, *Microphthalma michiganensis*, Towns., was obtained from Canada in 1930 in the hope that it would control such important cane-grubs as the Dynastid, *Pseudoholophylla furfuracea*, Burm., and the Melolonthids, *Lepidiota trichosterna*, Lea, and *L. frenchi*, Blackb., in Queensland, but owing to high mortality of the host grubs in transit, the supply of parasites bred out was insufficient to secure mating. It has therefore been decided to obtain a further supply.

Summerville (W. A. T.). **The Larger Horned Citrus Bug** (*Biprorulus bibax* **Breddin**).—*Queensland Agric. J.*, xxxvi, pt. 6, pp. 543–588, 9 pls. Brisbane, 1st December 1931.

Investigations were commenced in 1929 on *Biprorulus bibax*, Bredd., a serious pest of all varieties of *Citrus* grown commercially in Queensland. It is confined to Australia and is the only known species of its genus. All stages are described. The extent of the damage has apparently increased with the development of the citrus-growing industry, especially in localities having an annual rainfall of 30 ins. or less. No plant of economic importance is attacked other than *Citrus*, of which lemons and a variety of mandarins are preferred. The bugs also breed in summer on the indigenous plant, *Eremocitrus glauca*, and observations indicate that they probably occur in winter on some other food-plant that is fruiting at that time, possibly *C. australasica* (finger lime) or *C. australis*.

The eggs are laid in batches on the aerial portions of the tree, except the floral parts, and most usually on the upper surface of the leaves near the midrib. On hatching, the nymphs remain congregated and feeding does not commence until the second instar. The length of the stages varies according to the season ; in the laboratory the egg stage lasted 3–12 days, and the five nymphal instars 2–7, 2–14, 3–15, 4–17, and 7–23 days, respectively. The adults are strong fliers, and both sexes are present in about equal numbers. They are not sexually mature until about 14 days after emergence, and oviposition usually begins within 2 days of pairing. A daily minimum temperature of 40° F. and a maximum of 80° for about 10–14 days appears to be necessary for oviposition. The adults and older nymphs are able to eject a secretion that may cause severe skin irritation. The winter is passed in the adult stage, and there are four generations in a year, oviposition occurring in September, late November and December,

January and February. Owing to various factors, overlapping of the generations is not pronounced until February.

The bugs suck the juices of the fruits, which turn yellow prematurely and drop. In addition to the shrivelling of the tissues of the fruit, infestation is followed by disintegration and the formation of a gummy substance. This is rarely found in oranges and never in mandarins, both of which fall soon after infestation, but is observed in lemons over 1½ ins. long. Fruit in all stages of development is attacked, though the most forward fruits available appear to be preferred.

Citrus orchards only remain free from infestation for limited periods, and as there is no evidence of migration from one orchard to another, it is concluded that the adults are attracted from the native food-plants to the lemon trees in the orchards at the time of the commencement of each generation. The migration is intense for not more than 14 days, and usually takes place from one direction.

Where lemons are grown, all other varieties of *Citrus* should be stripped of mature and second crop fruit as early in the spring as possible, and the best results will be obtained if this is done before September. The infestation is thus confined to a limited number of trees, which should be hand-picked or fumigated. If fumigation is necessary, it should be delayed until November, when there are few eggs and when a higher mortality of Coccids will be obtained. Systematic hand-picking should be carried out in the early morning or late afternoon. If the removal of this fruit is not economically possible, all fruit should be removed from other varieties, particularly favoured mandarins. The older fruit, which will nearly always be oranges, should then be examined regularly and the bugs destroyed at short intervals. Control measures are seldom necessary in December owing to the work of the egg parasites, *Trissolcus flaviscapus*, Dodd, *Eupelmus biproruli*, Gir., *Pachycrepis tectacorisi*, Gir., *Telenomus glabriscrobus*, Gir., and *T. biproruli*, Gir., the last-named being the most abundant. Two predacious bugs, the Reduviid, *Pristhesancus papuensis*, Stål, and a Pentatomid, probably *Amyotea* (*Strachia*) *erythromela*, Wlk., exercise a certain amount of control, the former being the more valuable. If these natural enemies are not sufficiently abundant, hand-picking should be practised or a spray of 10 lb. finely-ground resin, 3 lb. caustic soda, 1½ lb. fish oil and 2 gals. water, diluted to 40 gals. should be used. In January, which is the important time for control measures, the trees should be fumigated with calcium cyanide as soon as the migration has lost its intensity. Hydrocyanic acid gas generated from calcium cyanide dust was found to be more effective than that generated by the interaction of sulphuric acid and potassium or sodium cyanide. During investigations, treatment during the latter part of the second week of January was very successful. Operations should be commenced on the far side of the orchard, advancing towards the infestation. In cases of extreme infestation due to prolonged migration a second fumigation may be necessary. Half strength dosage should be used for one application, preferably the first, and the second should follow in about 6–30 days.

When a new orchard is planted in a district in which the direction of infestation is known, the lemon trees should be planted on the face nearest the source to retard the spread of the pest. As the more heavily foliaged trees are preferred, it is advisable to keep trees of favoured varieties well pruned. Clusters of adults found on the trees in winter should be immediately destroyed.

Dadswell (I. W.) & Dadswell (H. E.). **The Relation between Durability and the Extractives of the Cypress Pines** (*Callitris* **spp.).** —*J. Council Sci. Ind. Res.*, iv, no. 4, pp. 208–216, 1 fig., 9 refs. Melbourne, November 1931.

In view of the importance of the preservation of timber in Australia, experiments were undertaken to determine the toxic or repellent principles existing in extracts from durable timber with a view to the utilisation of identical or similar compounds as preservatives against termite or fungus attack. Extracts from cypress pines (*Callitris* spp.), one of the most durable timbers in the Commonwealth, were employed, as well as several specific fractions (including a volatile acid and an ether soluble resin) isolated from the volatile oil and alcoholic extract. The method of isolation is described. In the tests against termites, carried out in co-operation with G. F. Hill, numbers of pieces ($6'' \times 1'' \times \frac{1}{4}''$) of the sapwood of *Pinus radiata*, a non-durable wood, were dried at 105° C. for 1 or 2 hours and samples were immersed in alcoholic solutions of each of the isolated fractions and of the original alcoholic extract in concentrations corresponding to the percentage of the same material present in *C. glauca*. Hot and cold aqueous extracts were also used. After 24 hours, the sticks were removed and the alcohol allowed to evaporate at room temperature. Control samples were treated with alcohol alone. Negative results were obtained in the field, for though all samples were placed in mounds of *Eutermes exitiosus*, Hill, for periods up to 12 months, the controls in most cases showed no signs of attack. Further exposure was considered useless, and representative treated and control samples were therefore placed in stoppered glass jars containing material from the nests of termites. After 2 months those treated with the ether soluble resin and the complete alcoholic extract were not attacked, but all other samples were destroyed.

As all the samples employed had been previously exposed to the weather during the summer, it was considered that some loss of volatile constituents had occurred, and a final series of tests with newly impregnated wood was undertaken. Groups of 4 sticks ($4'' \times 1'' \times \frac{1}{4}''$) were impregnated as before with alcoholic solutions, and 2 control samples were placed in separate laboratory colonies of *E. exitiosus*. Up to the end of 42 days the only samples showing no signs of attack were those treated with the volatile acid (1·4 per cent.) and the ether soluble resin (1·9 per cent.). At the end of 192 days, however, samples previously resistant showed signs of attack. During this period the colonies had to be replaced 6 times in order to maintain them in an active condition, though whether the decrease in the numbers of termites was due to natural causes or to the toxic properties of the materials present in the wood was not definitely determined.

The Underground Grass-grub in Victoria and Tasmania—a possible Parasite.—*J. Council Sci. Ind. Res.*, iv, no. 4, p. 252. Melbourne, November 1931.

A consignment of *Hystricia lupina*, Swed., a Tachinid parasite of the underground grass grubs (*Porina*) in New Zealand, has been received in Australia, where tests with it will be made against the allied Hepialids of the genus *Oncopera* [*cf. R.A.E.*, A, xix, 601]. The larva enters the burrow of its host, which is finally destroyed in the pupal stage.

An Insect Pest of Pine Trees—the Pine Aphis.—*J. Council Sci. Ind. Res.*, iv, no. 4, pp. 253–254. Melbourne, November 1931.

Recently planted pines have been attacked by an insect which is almost certainly *Chermes pini*, L. In Europe the damage caused to pines by this Aphid is practically negligible, owing to weather conditions and natural enemies, but in Australia there is evidence that the insect is liable to be numerous and in certain places may be of economic importance.

Allman (S. L.). **Codling Moth Experiments, 1930–31. Results obtained at Bathurst Experiment Farm.**—*Agric. Gaz. N.S.W.*, xlii, pts. 10 & 12, pp. 810–816, 955–961, 7 figs. Sydney, 1st October & 1st December 1931.

In continuation of experiments previously described [*R.A.E.*, A, xix, 194], details are given of a number of tests carried out in New South Wales in special plots and on a large scale in the field with a view to controlling the codling moth [*Cydia pomonella*, L.] on apples.

The following is largely taken from the author's summary: Six applications of lead arsenate spray resulted in 27·53 per cent. infestation, and four applications at the same strength in 39·95, as compared with 78·86 in the untreated plot. A combination of white oil and lead arsenate proved to be most efficient in control, and the use of lime-sulphur in all five cover sprays gave very satisfactory results. Casein-lime spreader is necessary to minimise the reaction between lime-sulphur and lead arsenate. Lead arsenate formed the common basis of the most satisfactory spray mixtures; of the non-arsenicals tried, a combination of white oil and nicotine sulphate proved the best. The degree of control obtained by a 75 per cent. lead arsenate dust was slightly better than that by lead arsenate spray alone, but not equal to that by lead arsenate plus white oil. Any reduction in the number of applications reduced the degree of control. Casein-lime spreader with the lead arsenate gave slightly better control. Various white oils tested gave inferior results when used alone. A mixture of nicotine sulphate and tannic acid (nicotine tannate) gave little control.

Tar distillate with lead arsenate spray even in dilute form scorched so severely as to preclude its use. In laboratory experiments white oil combinations proved to be good ovicides, but a white oil in which a contact insecticide was incorporated, used early in the season, caused excessive dropping of small fruit. For the first time in five years' experience, the use of white oils in four or five cover sprays resulted in a little injury to some of the fruit. Some varietal difference in reaction to spray injury is indicated. The use of oiled bandages on fruit trees is not recommended as severe injury was done to the trunk; the use of untreated bandages and regular destruction of the larvae is, however, strongly advised.

Savage (C. G.) & Ballantyne (J. A.). **The Effects of Lime-sulphur and White Oil Sprays on Jonathan Apple Trees. Experiments at Bathurst Experiment Farm.**—*Agric. Gaz. N.S.W.*, xlii, pt. 12, pp. 947–954. Sydney, 1st December 1931.

Spraying tests on Jonathan apple trees showed that definite damage resulted both to the tree and fruit when white spraying oils and lime-sulphur sprays were applied within five days of each other. When

the interval between the applications was extended to 10 days, no damage was apparent. The tests are being continued to ascertain whether there is a cumulative effect when similar sprays are applied to the same trees over a number of years.

Morgan (W. L.). **The Tomato Stem Caterpillar** (*Phthorimaea plaesiosema* **Turner**).—*Agric. Gaz. N.S.W.*, xlii, pt. 12, pp. 919–921, 5 figs. Sydney, 1st December 1931.

The larvae of the moth, *Phthorimaea plaesiosema*, Turn., have been known to attack tomato plants in the Sydney district since 1923, and in 1931 the extent of the damage became serious. A study of its life-history showed that the eggs are deposited singly on the foliage of tomato plants and also in the eyes of potato tubers or in cracks or scars. They hatch in from 7 to 11 days, and the young larvae mine into the tissues of the leaves and later make their way into the petioles, working down these into the stems. They sometimes enter the fruit at its attachment with the stalk or pedicle, and although not feeding extensively, may tunnel towards the centre. They pupate in tomato stems in small silken cocoons, but leave potato tubers to pupate in the soil. In warm weather the larval stage lasted 3 weeks and in winter about 6. The adult, which is described, emerges in 10 to 14 days after pupation. Moths fed on honey and water lived for 3–4 weeks, one surviving for 37 days. Oviposition began 7 to 9 days after emergence and continued for from 7 to 18 days, one female depositing about 300 eggs. During the summer and early autumn, two generations appeared in rather less than 4 months, but the third, bred during the winter, required approximately 4 months for development. A spray of 1½ lb. lead arsenate powder in 20 gals. water or a 50 per cent. lead arsenate dust, applied at weekly intervals, is recommended, and all dead or badly infested plants should be burned to destroy the larvae and pupae.

New South Wales: Plant Diseases Act, 1924, Proclamation.—*Govt. Gaz.*, no. 112, reprint 1 p. Sydney, 28th August 1931.

The introduction of any plant or fruit infested with *Chrysomphalus aurantii*, Mask., into certain stated areas of New South Wales is prohibited under the Plant Diseases Act, 1924 [*R.A.E.*, A, xiii, 227].

New South Wales: Plant Diseases Act, 1924, Proclamation.—*Govt. Gaz.*, no. 141, reprint 1 p. Sydney, 23rd October 1931.

The cherry aphis, *Myzus cerasi*, F., is declared a pest under the Plant Diseases Act, 1924 [*R.A.E.*, A, xiii, 227] within certain prescribed areas in New South Wales.

New South Wales: Plant Diseases Act, 1924, Proclamation.—*Govt. Gaz.*, no. 145, reprint 1 p. Sydney, 6th November 1931.

Measures prescribed for the control of Trypetids (fruit-flies) in virtue of the Plant Diseases Act, 1924 [*R.A.E.*, A, xiii, 227] in certain prescribed areas of New South Wales involve the collection of all fallen *Citrus*, pome, stone, loquat and guava fruits at least once in every three days, the boiling or burying of all infested and fallen fruits within like intervals, and the removal from the trees of all Seville

oranges belonging to the intermediate crop not later than 1st July, and all those belonging to the main crop not later than 1st September in each year. All owners or occupiers of land within certain prescribed areas must apply to the foliage of each pome, stone, loquat or guava tree 8 fl. oz. of spray at least once in every period of 7 days, for a period of 5 weeks immediately preceding the commencement of the harvesting or the ripening, whichever is the earlier, of the fruits of these trees. The spray must consist of 1 gal. fruit syrup, made by boiling 5 lb. fruit in 1 gal. water, 3 gals. water, 4 lb. molasses or treacle and 5 oz. lead arsenate powder.

HOFFMANN (W. E.). **Eradication of Nightshade** (*Solanum nigrum* **L.**) **as an Aid in the Control of Insects of economic Importance in South China.**—*Lingnan Sci. J.*, x, no. 1, pp. 113–115, 2 refs. Canton, April 1931. [Recd. January 1932.]

Investigations conducted over a number of years in South China have shown that the destruction of nightshade (*Solanum nigrum*) would aid considerably in the control of insects attacking crops of economic importance, particularly those that are able to maintain themselves on this plant in the absence of their preferred food-plants. Among those feeding on it are : *Epilachna vigintioctopunctata*, F., which also feeds on egg-plant (*Solanum melongena*) ; the Lygaeids, *Lygaeus hospes*, F., on Cape gooseberry (*Physalis peruviana*), and *Aphanus sordidus*, F., which has not been found attacking any other plant ; the Pentatomids, *Eusarcoris guttiger*, Thnb., *Tolumnia latipes*, Dall., *Nezara viridula*, L., *Plautia fimbriata*, F., *Halyomorpha picus*, F., and *Coptosoma variegatum*, H.-S., on various beans and other plants ; and the Coreid, *Acanthocoris scabrator*, F., on *Capsicum* spp., *S. melongena*, *P. peruviana*, and cucurbits. In the case of the first five, nightshade appears to be the preferred food-plant.

HOFFMANN (W. E.). **Notes on the Coreid,** *Anoplocnemis phasiana* **Fabr.** —*Lingnan Sci. J.*, x, no. 1, pp. 131–133. Canton, April 1931.

Anoplocnemis phasiana, F., the food-plants and distribution of which are discussed, has been found feeding in Canton on various species of beans, pigeon pea (*Cajanus indicus*), *Hibiscus rosa-sinensis*, and a number of other plants. Adults were present in the field from 16th April to 30th October, the eggs from 21st May to 20th August, and the nymphs from 26th May to 26th December, the adults of the new generation appearing as early as 6th July. The eggs are laid in masses of up to 18 and require 11 days to hatch during the latter half of May. The nymphal period lasted 25–30 days between mid-August and mid-September. Mating was observed to occur as early as 3rd May. Hand-picking just before oviposition begins is considered the most practical control measure.

HOFFMANN (W. E.). **The Food Plants of the adult Cercopid,** *Cosmoscarta bimaculata* **Walk.**—*Lingnan Sci. J.*, x, no. 1, p. 133. Canton, April 1931.

The adults of *Cosmoscarta bimaculata*, Wlk., which are commonly found on banana (*Musa sapientum*) in South China, have also been observed occasionally feeding on a number of other plants. These include *Canna* sp., *Vigna sesquipedalis* and grape-vines. This Cercopid also occurs in Tonkin.

Falkenstein (R. B.). **A general biological Study of the Lychee Stink Bug,** *Tessaratoma papillosa*, **Drur. (Heteroptera, Pentatomidae).**—*Lingnan Sci. J.*, x, no. 1, pp. 29–82, 2 pls., 14 refs. Canton, April 1931.

An account is given of the bionomics and morphology of the Pentatomid, *Tessaratoma papillosa*, Dru., which is very injurious to the litchee (*Litchi chinensis*) in South China, and of the unidentified parasites that attack its eggs, a preliminary and shorter version of which has already been noticed [*R.A.E.*, A, xiv, 43].

Hartman (E.). **A preliminary Note on one Method of destroying the Nymphs of the Litchi Stink Bug.**—*Lingnan Sci. J.*, x, no. 2–3, pp. 283–286, 1 pl. Canton, August 1931.

The preferred food-plants of *Tessaratoma papillosa*, Dru. [see preceding paper] in South China appear to be litchee trees [*Litchi chinensis*] and lungan [*Euphorbia longana*], but the bugs have also been found feeding on *Oxalis repens*, *Veronia*, *Polygonum*, and *Alternanthera*, though it has not been determined whether they can attain maturity on these plants. As the nymphs are known to migrate by ascending the litchee trees, sticky bands composed of a mixture of resin and tung oil were used to trap them with much success. A better adhesive was found, however, in a mixture of 3 parts by weight of castor oil to 7 parts of resin, which only requires to be heated until the materials are thoroughly mixed. This remains sticky longer than the other combination, and although on hot days it melts and runs down the trunks of the trees to the ground, it still catches many bugs. The mixture has only been tried on fairly small trees, on which the number of bugs was further greatly reduced by causing them to fall by jarring the trunks. On large trees it would probably be necessary to paint the material on the limbs. Nymphs on the ground are readily devoured by fowls.

Kojima (T.). **Further Investigation on the immature Stages of some Japanese Cerambycid-beetles, with Notes of their Habits.**—*J. Coll. Agric. Tokyo*, xi, no. 3, pp. 263–308, 1 pl., 14 figs., refs. Tokyo, 20th November 1931.

In continuation of previous work [*R.A.E.*, A, xvii, 565], descriptions are given of the immature stages of various Longicorns from Japan, with notes on their biology and distribution. They include the Prionid, *Megopis sinica*, White, which bores in the wood of some living broad-leaved trees and dead conifers; the Cerambycids, *Mallambyx raddei*, Blessig, which attacks chestnut (*Castanea sativa*), *Pasania cuspidata* and oaks, practically hollowing out the trunk, and *Ceresium sinicum*, White, the habits of which are little known, though in China the larvae found in the pupal chamber in twigs of mulberry are used as food for cage-birds; and the Lamiids, *Monochamus grandis*, Waterh., *M. sartor*, F., and *M. tesserula*, White, which attack living and dead conifers, *Melanauster chinensis*, Frst. which is sometimes a serious pest, its food-plants including *Citrus*, *Melia japonica*, *Salix*, mulberry, wild apple, *Platanus orientalis* and *Mallotus japonicus* in Japan, *Cajanus indicus*, *Casuarina equisetifolium* and *Melia azedarach* in Formosa, and *Populus alba* in China, *Eupromus ruber*, Dal., which

seriously damages the cambial region of camphor (*Cinnamomum camphora*) and *Machinus longifolia*, and *Paraglenea fortunei*, Saund., which infests the stems of *Boehmeria nivea* (ramie).

Sonan (J.). **Studies on** *Brachytrypes portentosus*, **Licht., and Methods for its Control.** [*In Japanese.*]—*Bull. Dept. Agric. Govt. Res. Inst. Formosa*, no. 86, pp. 1–22. Taihoku, Formosa, 1931.

The cricket, *Brachytrypes portentosus*, Licht., is one of the most injurious pests in Formosa. It has one generation a year, the adults beginning to appear in mid-May in the southern part of the Island and at the end of June in the north. Hibernation takes place in the nymphal stage, which lasts 10 months. The crickets bore holes in the ground about 20–40 ins. long. The eggs, which hatch in about a month, are laid in masses of about 50, one mass being found in each hole. The insects remain in the holes by day and attack various plants at night, cutting them off and carrying them into their holes. They are readily killed by carbon bisulphide (2 gm. to a hole), or by calcium cyanide.

Lopez (A. W.). **The Use of the Antennae as a means of determining the Sexes in** *Leucopholis irrorata* **Adults (Coleoptera, Scarabaeidae).** —*Philipp. J. Sci.*, xlvi, no. 4, pp. 759–761, 1 pl. Manila, 1931.

In the course of investigations on the sex ratio and egg contents of adults of *Leucopholis irrorata*, Chevr., which is an important pest of sugar-cane in the Philippines, it was found that the sexes could be distinguished by the length of the antennal club, which is approximately 0·57 mm. longer in the male than in the female, and by the difference in contour between the posterior edges of the extended antennal clubs of the two sexes. The size of the beetle does not apparently influence the length of the antennal club to any appreciable extent. The sexes of *Lepidiota pruinosa*, Wied., may be separated in a similar manner.

Doane (R. W.). **Common Pests.**—Large Cr. 8vo, viii+397 pp., 215 figs. Springfield, Ill., and Baltimore, Md., C. C. Thomas; London, Baillière, Tindall & Cox, 1931. Price 21*s.* net.

The author collates in this handbook the essential facts regarding the commoner pests that directly affect man, his domestic animals, crops, storehouses and household, primarily with reference to the United States. Although it deals chiefly with insects, chapters are included on parasitic worms, mammals and birds; practical methods of control are suggested wherever possible.

Powell, jr. (T. E.). **An ecological Study of the Tobacco Beetle,** *Lasioderma serricorne* **Fabr., with special Reference to its Life History and Control.**—*Ecol. Monog.*, i, pp. 333–393, 20 figs., 29 refs. Durham, N.C., July 1931. [Recd. January 1932.]

The following is taken from the author's summary of observations in North Carolina: The quality of food is a determining factor in the length of life-cycle of *Lasioderma serricorne*, F. When it is fed on yeast, which is apparently the most satisfactory food, its life-cycle is from 18 to 20 days shorter than when it is fed on tobacco. The egg can survive for 20 days at 2° C. [35·6° F.]. The optimum temperature is 32° C. [89·6° F.]; above and below this temperature the life-cycle

is lengthened. A much wider range of temperature is tolerated below the optimum than above; between 36 and 40° C. [96·8 and 104° F.] are temperatures fatal to all stages. Sustained humidities of 30 and 100 per cent. are fatal to the beetle; the optimum is about 75 per cent; above and below this the life-cycle is lengthened, with a wider range of tolerance to humidities below than above the optimum. Humidity above 90 per cent. is unfavourable because of the attacks of fungous and bacterial diseases; the mortality at low humidities is apparently due to desiccation, no beetles developing below 45 per cent. The average number of eggs deposited by females was 43, but oviposition never occurred in the absence of suitable material. Unmated females do not oviposit, though they may live for 2 or 3 months, but oviposition begins soon after mating. The physical form of a material alone is sufficient stimulus to oviposition provided that the size of particles supplied is small enough. Sand, crushed glass and sawdust passing through a no. 0000 sieve incited to oviposition; other inorganic substances, not sized, which caused oviposition were iron filings, wool, glass-wool and powdered potassium dichromate. Odours are a weak stimulus to oviposition; hot water extracts of tobacco leaf are more efficient than nicotine solutions, but none of these odours are nearly so effective as natural tobacco. The beetle shows a preference for certain types or grades of tobacco. The length of the life-cycle is proportionately increased by the smaller sized particles of tobacco and by the poorer grades of tobacco or heavy-bodied, compact leaves. A preference is shown for the aroma of smooth, well-ripened tobacco leaves, the heavy-bodied grades being the least attractive. When the same tobacco of different ages is tested, the type possessing the greatest age seems to have the aroma most acceptable to the beetle. The lethal effect of hydrocyanic acid gas is decreased when used in the presence of tobacco; the percentage of mortality is determined by the ratio existing between the amount of tobacco present and the concentration of the gas. Carbon bisulphide at a minimum dosage of 2 lb. per 1,000 cu. ft. kills all beetles under experimental conditions, but the fire hazard makes its use impracticable. Ethylene oxide at a minimum dosage of 24 oz. per 1,000 cu. ft. resulted in total mortality. The substance carboxide, consisting of 9 parts carbon dioxide to 1 part ethylene oxide, is absolutely non-inflammable and the lethal effect upon *L. serricorne* is increased, so that a charge of 16 oz. ethylene oxide to each 1,000 cu. ft. kills all the beetles; ethylene oxide in combination with carbon dioxide is recommended for the fumigation of tobacco warehouses, the necessary quantity being determined by the manner of storage and the amount of insect damage. Carboxide is recommended at the rate of 2 lb. of ethylene oxide to each 1,000 cu. ft.

Rumbold (C. T.). **Two blue-staining Fungi associated with Bark-beetle Infestation of Pines.**—*J. Agric. Res.*, xliii, no. 10, pp. 847–873, 8 figs., 16 refs. Washington, D.C., 15th November 1931.

An account is given of an investigation carried out to determine the blue-stain fungi associated with bark-beetle damage in the United States [*cf. R.A.E.*, A, xviii, 110, 111]. The history of the association between insect damage and blue-stain fungi is discussed from the literature. The Scolytids of the genus *Dendroctonus* are particularly dangerous to forests, since their attack often results in the death of even healthily growing trees, and those of the genus *Ips*, although they

are capable of killing healthy trees, are more liable to infest those that are injured or sickly. Many pines infested with bark-beetles of both genera have been found to be blue-stained, and enough evidence has been gathered to indicate an association of two distinct blue-stain fungi with them, namely, *Ceratostomella pini* with *Dendroctonus frontalis*, Zimm., and *D. brevicomis*, Lec., and *C. ips*, sp. n., with *Ips calligraphus*, Germ., and *I. grandicollis*, Eichh. These fungi grow from the galleries of the beetles, which lie within or just under the bark of the tree. *C. pini* has been found in the following species of pine infested with *Dendroctonus*: *Pinus echinata*, in North Carolina; *P. ponderosa*, in California and Idaho; and *P. taeda*, in Arkansas. It has also been observed near Washington, D.C., staining *P. virginiana* infested with insects other than *Dendroctonus* and with mites. *C. ips* has been found in the following species of pine infested by *Ips*: *P. echinata*, in North Carolina; *P. rigida*, in Maryland; *P. sylvestris*, in New Jersey; *P. resinosa*, in Pennsylvania; *P. palustris*, in Florida; and *P. strobus*, in Massachusetts. Both fungi are described in detail, and characters distinguishing them and the stains produced by them are indicated. Brief descriptions are also given of *Leptographum lundberghi* and *Atractina* sp., two other fungi found in pines in association with *Dendroctonus monticolae*, Hopk., and *D. ponderosae*, Hopk., respectively.

Orr (L. W.). **Studies on natural vs. artificial Control of the Pine Tortoise Scale.**—*Tech. Bull. Minnesota Agric. Expt. Sta.*, no. 79, 19 pp., 4 diag., 1 ref. St. Paul, Minn., June 1931. [Recd. January 1932.]

This paper is a preliminary report on several phases of a study on the relation of *Toumeyella numismatica*, Pettit & McD., to the management of plantations of Jack pine [*Pinus banksiana*] and Scots pine [*P. sylvestris*]. The outbreak under investigation in Minnesota was first reported in 1926, and in the spring of 1929 was found to have increased considerably, stands of both *P. banksiana* and *P. sylvestris* being attacked. Norway pine [*P. resinosa*] and certain trees of the other two species appeared to be immune, and the development of a resistant strain may be possible. The Coccids on trees weakened by several seasons of attack were smaller than those on trees more recently infested. The males appear in late summer and die after fertilising the partly developed females, which overwinter and continue growing the following spring. Oviposition lasted from about 10th June to 1st July, the eggs hatching almost immediately. The egg-laying period for one female apparently lasts about 10–14 days. Most of the young scales settle on the new growth, though some establish themselves on the older parts of the branches where the bark is still smooth and succulent. It appears that infestation is most likely to spread through the transport of infested nursery stock.

Numbers of the Encyrtid, *Microterys fuscicornis*, How., were reared from scales from a few branches of *P. banksiana* taken in May, and larvae of the following Coccinellids were found feeding on the Coccids: *Chilocorus bivulnerus*, Muls., *Scymnus lacustris*, Lec., *Coccinella transversoguttata*, Fald., *C. novemnotata*, Herbst., *Brachyacantha ursina*, F., and *Hyperaspis signata*, Ol. (*binotata*, Say) [*cf. R.A.E.*, A, xx, 36], which was the most abundant.

There was every indication of further spread of *T. numismatica* in the summer of 1929, and spraying was therefore begun in April on more than four thousand trees of *P. sylvestris*. A commercial brand of white oil having a high content of saturated hydrocarbons was used; it is thought that a less highly refined oil might have given a higher percentage of mortality, though it might have caused more foliage injury. The stock emulsion was prepared of 1 lb. calcium caseinate, 3 U.S. gals. water and 8 U.S. gals. oil. The best results were obtained by using a hard, driving spray. A 4 per cent. spray was more satisfactory than a 3 and caused relatively little injury, though a 5 caused severe scorching. Proprietary oils used for comparison caused more injury. On 1st July there was considerably less infestation on the sprayed plots than on those that were not sprayed, though a few scattered Coccids were left on the former. By the end of July, however, the Coccinellids had reduced the infestation on the unsprayed plots to such an extent that the percentage of infested shoots was far less than on the treated plots. The predators, which were evidently repelled from the sprayed trees and therefore concentrated on the unsprayed ones, might not have proved so effective over the entire area had spraying not taken place.

Mackie (D. B.). **The Citrus White Fly in California.**—*Mon. Bull. Dept. Agric. California*, xx, no. 10–11, pp. 599–612, 5 figs. Sacramento, Cal., October–November 1931.

An account is given of the campaign against *Dialeurodes citri*, R. & H., in California, some of the information on the earlier work having already been noticed [*cf. R.A.E.*, A, xvii, 65]. In the case of preferred deciduous food-plants, such as persimmon and umbrella trees (*Melia azedarach*), the Aleurodids, as a result of crowding, have developed a tendency to persist on the plants, with a result that large numbers perish each autumn when the leaves are shed. Thus all infestation of deciduous stock has resulted from the migration of adults that had overwintered as larvae on preferred evergreens. Owing to a general recession of the pest to preferred food-plants, spraying operations are at present practically confined to *Citrus* and privet. A survey conducted in one locality shows the average reduction in the population of the whitefly over a period of 4 years effected by the campaign and environmental factors to be 98·25 per cent.

Keifer (H. H.). **Notes on some California Lepidoptera of economic Interest.**—*Mon. Bull. Dept. Agric. California*, xx, no. 10–11, pp. 613–626, 13 figs., 1 ref. Sacramento, Cal., October–November 1931.

Notes are given on a number of Lepidopterous pests, some of which, owing to abnormal climatic conditions, were unusually numerous in California during the summer of 1931, with brief descriptions of the adults and larvae of many of them. The species concerned are: *Laphygma frugiperda*, S. & A., which probably has not been previously reported from the State, and which caused serious injury to sweet maize; *L. exigua*, Hb., on asparagus, beans, peas and particularly lettuce; *Heliothis obsoleta*, F., the larvae of which damaged a large variety of crops and were taken on leaves of avocado in one locality; *Pyrausta gracilalis*, Hulst, on privet; *Tholeria reversalis*, Gn., on

Genista; *Crambus leachellus*, Zinck., damaging lawns; *Euzophera semifuneralis*, Wlk., the larvae of which were found tunnelling beneath the bark of walnut and oriental plane trees [*Platanus orientalis*]; *Ephestia figulilella*, Gregson, in grapes; *Cydia* (*Melissopus*) *latiferreana*, Wlsm., on walnuts; *Anarsia lineatella*, Zell., which damaged up to 20 per cent. of the fruit of peaches in some districts; *Gelechia desiliens*, Meyr., on native sycamore (*Platanus racemosa*); *G. trichostola*, Meyr., on oaks; and *Phthorimaea* (*Gnorimoschema*) *lycopersicella*, Busck, on *Solanum xantii* [*cf. R.A.E.*, A, xix, 654]. Shelled almonds in storehouses were attacked by *Ephestia cautella*, Wlk., and *Plodia interpunctella*, Hb.

Browne (A. C.). *Oecanthus niveus* (**De Geer**) **in some California Fruits.**—*Mon. Bull. Dept. Agric. California*, xx, no. 10–11, pp. 633–643, 5 figs., 11 refs. Sacramento, Cal., October–November 1931.

Notes are given on the bionomics of *Oecanthus niveus*, DeG., on fruit trees in California, with particular reference to apple. In addition to the latter, pears and a number of stone fruits are attacked. Observations on its life-history on apple, which is somewhat similar to that on raspberries [*cf. R.A.E.*, A, xix, 318], show that oviposition begins in late August and probably continues until the frost kills the females. One generation occurs during the year. Since the nymphs hatch from the overwintered eggs long before the fruit is ripe, feeding probably occurs on the foliage; the fruit is not attacked until they have reached the last two instars. The crickets make holes in the apples and in this way are responsible for the introduction of various rots that damage the fruit in storage. Injury is also caused to the twigs by egg-punctures, the latter providing entry for numerous secondary bark- and wood-destroying fungi, with a result that in cases of severe infestation the affected parts of the tree are killed. Injury to apples in one locality varied from 10 to 75 per cent. Measures for control on food-plants other than apple are discussed [*cf. loc. cit.* and xiv, 448]. The fruit of apple trees dusted in mid-July with sodium fluosilicate at the rate of 25 lb. to the acre showed no injury by the crickets at harvest time, whereas much of the fruit was damaged on adjacent trees.

Lockwood (S.). **An economic Survey of the Navel Orange Worm,** *Myelois venipars*, **Dyar, in Arizona.**—*Mon. Bull. Dept. Agric. California*, xx, no. 10–11, pp. 655–660. Sacramento, Cal., October–November 1931.

An account is given of investigations already briefly noticed [*R.A.E.*, A, xix, 691], which were carried out in Arizona during October 1930, to determine the economic importance of *Myelois venipars*, Dyar, on *Citrus*. The results show that the attacks of this Pyralid were confined to split fruit, or that infected with black rot (*Alternaria citri*), no evidence being found that the larvae are able to enter sound fruit. In the only two cases in which larvae were found on whole fruit, they had died, apparently after having failed to penetrate the peel. The author is doubtful whether the larvae can be regarded as disseminators of black rot, since infection was not always associated with their presence and they were also found in uninfected fruit. Moreover, the fungus is known to occur in California, where *M. venipars* has not been found.

Mackie (D. B.) & Jones (M. L.). **Some biological Aspects of the 1931 Peach Situation.**—*Mon. Bull. Dept. Agric. California*, xx, no. 10–11, pp. 661–665, 2 figs. Sacramento, Cal., October–November 1931.

The annual increase in the growing of peaches for canning in central California has led in recent years to overproduction, and the peach twig borer [*Anarsia lineatella*, Zell.] has developed in abnormal numbers in the surplus crop left unpicked to rot on the ground. In 1931 the position became very serious indeed; abnormally favourable breeding conditions had produced overlapping of the generations to such an extent that all stages of the moth could be found on the same day, so that control measures could not be effective. Aeroplane dusting was resorted to, but the results were quite inadequate. Data are given showing the degree of infestation of the fruit, which varied considerably according to the locality, but averaged over 10 per cent. for all parts of the northern cling-peach belt and was as high as 70 per cent. on individual properties, the heaviest infestation occurring as expected in the late maturing varieties. In order to determine whether disking under of fallen fruit would reduce the numbers of overwintering larvae, both whole and cut fruits were buried in damp and dry soil. It was found that the fruit thus treated decomposed in a maximum of 120 hours.

Eberling (W.). **Method for Determination of the Efficiency of Sprays and HCN Gas used in the Control of Red Scale.**—*Mon. Bull. Dept. Agric. California*, xx, no. 10–11, pp. 669–672. Sacramento, Cal., October–November 1931.

In attempting to arrive at a standard method for estimating the rate of mortality of the red scale [*Chrysomphalus aurantii*, Mask.] on *Citrus* after treatment with oil sprays or hydrocyanic acid gas, branches, leaves, twigs and fruits were examined. After either treatment a great difference was found between the percentages of survival on various parts of the tree. In case of fumigation, there was a much lower mortality on lemon in spite of the fact that a higher dosage of the fumigant was used. The usual practice of counting scales on the fruit only in fumigated groves appears to be sound, for survival is greatest on the fruit, and a large number of Coccids can be procured in less time than on other parts of the tree. This procedure, however, is very misleading in making counts in sprayed groves, unless it is recognised that the survival on the branches may be seven or eight times as great as that on the fruit. Moreover, as fruit is periodically removed from the tree, it is a very much less important source of reinfestation than the branches. Counts for determination of the efficiency of a spray should therefore be made on the latter.

Boyce (A. M.). **Effectiveness of certain Materials in producing Mortality of the Walnut Husk Fly,** *Rhagoletis completa* **Cress.**—*Mon. Bull. Dept. Agric. California*, xx, no. 10–11, pp. 682–690, 8 figs., 4 refs. Sacramento, Cal., October–November 1931.

An account is given of laboratory experiments, the technique of which is described in detail, conducted in California during 1929–30, with a number of insecticides against *Rhagoletis suavis completa*, Cress., and brief reference is made to their effect on walnut foliage in the field.

Since at the outset of the experiments basic lead arsenate was the only known promising insecticide that could be used as a stomach poison without causing injury to the trees, this material received first attention. There was, however, some doubt as to its efficiency in comparison with acid lead arsenate, as the latter contains approximately 30 per cent. more arsenic oxide ($AS_2 O_5$) and also a greater amount that is water-soluble. When used in a spray, each material was tested at the rate of 1 part to a 10 per cent. sugar solution. The sugar was included as the flies die rapidly when confined without food under the conditions of the experiments. As a dust each insecticide was tested at a concentration of 20 per cent. by weight, the remainder of the mixture consisting of 10 per cent. powdered cane sugar and 70 per cent. carrier (either talc or hydrated lime). Two methods were used in the experiments. In the first both the sprays and the dusts were applied to walnuts on twigs at the rate of 5 cc. and 1 gm. to 2 nuts respectively. In the second 5 gm. of dust were applied to a wick saturated in 10 per cent. sugar solution.

All the arsenicals tested were effective against the flies, but basic lead arsenate was the only one that did not injure the foliage in tree tolerance tests. The degree of injury from the others was directly proportionate to the rapidity of their lethal effect on the flies. Basic lead arsenate was more rapid in its action as a dust than as a spray, possibly because more of the dust adhered to the walnuts. Barium and sodium fluoride, barium, sodium and magnesium fluosilicate, and cryolite (sodium fluoaluminate) were effective, but calcium fluoride and calcium fluosilicate compound proved unsatisfactory. Apparently greater concentration of both barium fluosilicate and cryolite resulted when they were applied as sprays. Of the fluorines tested, the calcium and barium combinations can be safely used on walnut foliage. Copper sulphate and copper carbonate were effective, but caused serious injury to the foliage. The flies were also killed with talc or hydrated lime tested at a concentration of 90 per cent. to 10 per cent. powdered cane sugar ; there was some evidence that the flies in these tests were starved, possibly because the dust particles clogged the pseudotrachea of the labella. The results of tests with a spray of 40 per cent. nicotine sulphate (of which a stock solution of 75 cc. to 100 gm. sugar and 300 cc. water was applied at the rate 5 cc. in 95 cc. water) show that its action is very rapid as compared with other materials. The spray was allowed to dry on the nuts before the flies were placed in the cages. Previous tests indicated that the incorporation of sugar in the mixture prevents the quick volatilisation of the nicotine.

KLYVER (F. D.). **California Psyllids of present and potential economic Importance.**—*Mon. Bull. Dept. Agric. California*, xx, no. 10–11, pp. 691–697, 2 pls. Sacramento, Cal., October–November 1931.

Notes are given on a number of Psyllids occuring in California, showing their food-plants and distribution, preceded by a list of the species that are of economic importance in other countries.

WINBURN (T. F.) & PAINTER (R. H.). **Insect Enemies of the Corn Earworm** (*Heliothis obsoleta* **Fabr.**).—*J. Kansas Ent. Soc.*, v, no. 1, pp. 1–28, 47 refs. McPherson, Kans., January 1932.

A list is given of 82 insect enemies of *Heliothis obsoleta*, F., in various parts of the world, based on a survey of the literature, of which 46 are Hymenoptera and 22 Diptera. Collection of the parasites of *H.*

obsoleta on maize and lucerne, carried out in Kansas from May till October 1930, revealed the presence of two new insect enemies, *Chrysopa plorabunda*, Fitch, and a species of *Microplitis*, near *M. melianae*, Vier. The egg parasites, *Trichogramma minutum*, Riley, and *Telenomus heliothidis*, Ashm., the larval parasite, *Microplitis croceipes*, Cress., and the predacious Anthocorid, *Orius insidiosus*, Say, are the most important enemies of *H. obsoleta* in Kansas. The parasites were bred in the insectary, and notes are given on their biology. In no case did more than one adult of *T. heliothidis* emerge from one host egg. The time required for development varied from 12 to 32 days. Unmated individuals lived on an average 21 days, with a maximum of 40, but males died from 3 to 5 days after mating and females shortly after oviposition. It is possible that *T. heliothidis* can survive the winter in the host egg. The developmental period of *Trichogramma minutum* from oviposition to emergence from the host egg varied from 8 to 10 days, and the number of parasites emerging from each egg varied from 1 to 4 with an average of 2·5. The average length of life of adults was $1\frac{1}{2}$ days, with a maximum of 4.

Mites and Nematodes, which were identified as *Diplogaster aerivora*, Cobb, killed a number of larvae of *Heliothis obsoleta*. The Nematodes took an average of 8 days to kill a larva and another 7 days to eat their way out through the body wall. *M. croceipes*, a description of which is quoted, parasitised 55·3 per cent. of one collection of larvae of *H. obsoleta*, and Quaintance and Brues (1905) found that 55 per cent. of the eggs and many of the small larvae were destroyed by *O. insidiosus* [*cf. R.A.E.*, A, xviii, 489]. During the autumn of 1929 numerous larvae of *Chauliognathus marginatus*, F., were collected while in the act of destroying the larvae of *H. obsoleta*. They hibernated in the soil, and the first larva pupated during May, the adult beetle emerging on 26th June. Coccinellid larvae reared to maturity on small larvae on *H. obsoleta* were *Ceratomegilla fuscilabris*, Muls., and *Hippodamia convergens*, Guér.

The rate of parasitism of *H. obsoleta* on maize is very low, indicating the need for a parasite having a long ovipositor or habits that will enable it to reach the host larvae in spite of the protecting maize husks. An unnamed parasite obtained by Bogoljubov in 1913 [*R.A.E.*, A, ii, 74] in Turkestan [*cf.* also ii, 423, 515] may be of this type and might prove valuable if introduced.

SPRINGER (R. E.). **Some Factors affecting the Hatching of the Eggs of the European Corn Borer.**—*Proc. Pennsylvania Acad. Sci.*, iv, pp. 99–102, 1 graph. Harrisburg, Pa., 1930.

In spite of the fact that the fertility of the eggs of *Pyrausta nubilalis*, Hb., is exceptionally high, an average of only 5·8 per cent. develop into larvae that survive to the third instar. In an investigation of the reasons for this high mortality using about 5,000 eggs, the author found that, eliminating other factors so far as possible, the result of exposure to ultra-violet rays was to cause a significant increase in viability followed by a rather rapid rise of the death rate.

STICHTER (G. B.). **Is the Flight of the Japanese Beetle necessarily restricted to a few Months of the Year?**—*Proc. Pennsylvania Acad. Sci.*, v, pp. 40–42, 4 refs. Harrisburg, Pa., 1931.

The adults of *Popillia japonica*, Newm., may be obtained out of doors near Philadelphia from early June to late October, and all the

year round in greenhouses. So far as climate is concerned, it is possible that the beetle might find more favourable conditions in parts of the United States other than the region from Massachusetts to Virginia that is at present infested. No condition of heat has been observed to be injurious to the eggs or larvae, provided that the soil is moist. The hot, dry summer in Pennsylvania in 1930 held in check depredations by various insects, of which *Popillia* was one. The beetles were found in the open earlier in the season, but did not increase so rapidly. Their activity on the wing is confined almost entirely to hot and sunny days, though thousands have been found feeding on plants during and directly after severe storms. Their flights are apparently short and erratic, both with and against the prevailing wind.

Speicher (B. R.). **The Effects of Desiccation upon the Growth and Development of the Mediterranean Flour-Moth.**—*Proc. Pennsylvania Acad. Sci.*, v, pp. 79–82, 1 fig., 6 refs. Harrisburg, Pa., 1931.

The following is the author's summary : A dry atmosphere and dry food have an appreciable effect on *Ephestia kühniella*, Zell., by diminishing its size and delaying pupation. Larvae reared in a dry atmosphere are inactive, apparently avoiding all movements involving loss of body moisture. Despite a dry atmosphere, the larvae and pupae maintain a constant percentage of free water in the body as long as they survive.

Payne (N. M.). **Effect of Temperature upon the Development and Life-length of** *Habrobracon juglandis* **Ashmead (Abstract).**—*Anat. Rec.*, li, no. 1, suppl., p. 24. Philadelphia, Pa., 25th November 1931.

Both the period of development and the duration of adult life of *Microbracon hebetor*, Say (*Habrobracon juglandis*, Ashm.) are affected by temperature. Length of development from egg to egg varies from 7 days at 36° C. [96·8° F.] to 45 days at 10° C. [50° F.]. The average life of males is always shorter than that of females. The length of life of adults varies from 90 days at 10° C. to 3 days at 36° C. Adults emerging at low temperatures live longer at high or low temperatures than do those emerging at high ones. The weight of adults varied inversely with the temperature at which they were bred.

McDaniel (E. I.). **Insect and allied Pests of Plants grown under Glass.**—*Spec. Bull. Michigan Agric. Expt. Sta.*, no. 214, 117 pp., 71 figs. East Lansing, Mich., June 1931. [Recd. January 1932.]

Brief notes are given on the life-history and control of insects attacking greenhouse plants in Michigan, the injury caused being described in most cases. The very considerable number of species dealt with are further classified under the plants attacked. Formulae are given for the most commonly used stomach poisons, contact insecticides and fumigants, and brief instructions are appended for their application.

Lathrop (F. H.) & McAlister, jr. (L. C.). **The Blueberry Maggot and its Control in eastern Maine.**—*Circ. U.S. Dept. Agric.*, no. 196, 13 pp., 9 figs., 2 refs. Washington, D.C., December 1931.

The following is taken from the authors' summary : Although blueberries infested with *Rhagoletis pomonella*, Walsh, may be washed

in order to reduce the number of maggots, this method is inconvenient and expensive (from 10–50 per cent. of the berries being destroyed in the process), and it is usually necessary to adopt control measures in the field. Regular care of blueberry land is important in the control of the fly, but it does not seem advisable to rely on cultural practices alone. Instructions are given for dusting the plants with calcium arsenate [*R.A.E.*, A, xviii, 645].

WAKELAND (C.) & WATERS (H.). **Controlling the Firebrat in Buildings by means of Poisoned Bait.**—*Bull. Idaho Agric. Expt. Sta.*, no. 185, 15 pp., 2 figs., 48 refs. Moscow, Ida., November 1931.

Thermobia domestica, Pack. (firebrat) is a destructive and annoying household pest that has been extremely rare in Idaho until recent years, when centrally heated buildings have become badly infested. In experiments to determine its preferred food, the results show that oatmeal containing between 5 and 50 per cent. of sugar and between $\frac{1}{8}$ and 5 per cent. of salt is very attractive to it. Of poisons added to such a mixture white arsenic was the most effective. Successful control was obtained by baits containing these ingredients in various proportions. The formula recommended is 100 parts finely ground oatmeal, 8 parts white arsenic, $2\frac{1}{2}$ parts salt and 5 parts sugar, moistened to a paste and then allowed to dry. The crumbled bait is spread lightly behind bookcases and pictures, around steam pipes, etc.

CALHOUN (P. W.). **A Correlation of the Date of Emergence and Percentage of Survival of the Cotton Boll Weevil with the Date of their Installation in Hibernation Cages.**—*Florida Ent.*, xv, no. 3, pp. 41–48, 6 refs. Gainesville, Fla., November 1931.

To determine the effect that the date of confining *Anthonomus grandis*, Boh., in hibernation cages in the autumn might have on the date of their emergence or the percentage of their survival, the data from eleven groups of hibernation cage experiments in Florida and one in Mansura, Louisiana, were examined. In nine groups of cages, placed either on the ground in open fields or on the ground or in trees in woods, the date of confining the weevils in the autumn apparently did not determine to any considerable extent the date of their emergence in the following spring, but in five groups on the ground in open fields, the date had a marked effect on the percentage of emergence. The highest percentages of survival always came from cages in which the weevils were introduced moderately late in the autumn. In four groups of cages placed in trees in woods, the date of confinement in the autumn seemed only slightly to affect the percentage of survival.

This, however, should not be interpreted to mean that the destruction of the green cotton stalks early in the autumn would prove of little benefit in localities where weevils are supposed to hibernate largely in mossy trees, as early stalk destruction greatly reduces the number that hibernate. Moreover, as cage hibernation tests have been found unreliable as a means of predicting the time of appearance of boll weevils in the cotton fields, it would be unsafe to conclude that destroying the stalks at different dates would have the same effect on the mortality of the overwintering weevils as does confinement in cages at different dates.

Nichol (A. A.). **Control of the Harvester Ant.**—*Bull. Arizona Agric. Expt. Sta.*, no. 138, pp. 639–652, 10 figs. Tucson, Ariz., 15th September 1931.

An account is given of experiments with various poisons and fumigants against harvester ants in Arizona [*cf. R.A.E.*, A, xix, 746]. The following mixture is particularly recommended: 20 oz. sodium arsenite, 5 oz. maize starch, 1 oz. Paris green, and 74 oz. precipitated calcium carbonate. It should be thoroughly mixed until the minimum amount of green colour is visible. In use 4–6 oz., according to the size of the nest, should be scattered in a loose ring 24–30 ins. in diameter round the opening, care being taken not to place it nearer than 10–12 ins. to this opening. Particles of the mixture adhere to the feet and bodies of the ants, and some are killed in cleaning themselves, whereas others carry the poison into the nest, where it eventually destroys the queen and young brood. In one locality, in which about 164 nests were treated, over 80 per cent. were destroyed with one application; in another against a different species of harvester ant the percentage of control was slightly lower. Where there is danger of leaching by rain or irrigation, the poison should not be placed too near to plants. In such cases 3 or 4 applications of a very thin film of the powder, at intervals of about 26–34 hours, will eradicate a nest. The old materials remaining after one treatment should be removed before making the next.

Service and Regulatory Announcements July–September 1931.—*U.S. Dept. Agric., P.Q.C.A.*, S.R.A., no. 108, pp. 91–134. Washington, D.C., December 1931.

Recent revisions and amendments to existing quarantine orders of the United States, which are given verbatim, include an announcement (P.Q.C.A. 316) relating to the Japanese beetle quarantine, No. 48, stating that the fumigation of berries with carbon bisulphide against *Popillia japonica*, Newm., has been authorised and applied with satisfactory results. Fumigation with ethylene oxide under specified conditions [*R.A.E.*, A, xx, 104] is also authorised as one of the conditions under which certificates may be granted for the interstate movement of berries from the generally infested area during the period 15th June to 15th October. A further announcement (P.Q.C.A. 317) authorises the fumigation of bananas in car-loads against *P. japonica* by means of an application of 1½ lb. hydrocyanic acid held in absorbent matter in disks spread out in paper trays at least 2 ft. by 6 ft. in area on the top of the load of bananas at the doorway of the refrigerator car, which is then tightly closed for a period of 1 hour, the temperature being maintained at 75° F. or over. This treatment has been applied experimentally to commercial shipments without affecting the bananas.

An announcement relating to the narcissus bulb quarantine, No. 62 [xiv, 492], authorises the fumigation with sodium cyanide of bulbs infested with bulb-flies [*Merodon equestris*, F., and *Eumerus* spp.] alone. Experiments have indicated that this treatment is at least equal to and may have some advantages over fumigation with calcium cyanide [xvii, 163]. The bulbs to be treated are to be exposed for 4 hours in trays not more than two layers deep placed in an air-tight room or box with a tightly closing lid. The dosage required is 7 oz. sodium cyanide that is at least 50 per cent. cyanogen, 10½ oz. sulphuric acid testing 66° Beaumé, and 14 oz. water for each 100 cu. ft.,

including the space occupied by the bulbs. The air temperature should be at least 60° F. and not more than 75 per cent. of the space in the fumigation chamber should be occupied by the bulbs and trays.

Verslag over de jaren 1928–1930. [Report of the Agricultural Experiment Station, Dutch Guiana, for 1928–1930.]—83 pp. Paramaribo, Dept. Landbouwproefst. Suriname, 1931.

Some insect pests are dealt with on pp. 46–47. On coffee *Coccus* (*Lecanium*) *viridis*, Green, was checked by spraying with 8 per cent. carbolineum. The numbers of the sugar-cane moth borer, *Diatraea saccharalis*, F., were kept down by destroying infested canes and selection of the material for planting. Another cane-borer, *Castnia licus*, Dru., was less abundant, and measures against *Aphis sacchari*, Zehnt., were unnecessary owing to the work of the predacious Coccinellids, *Ceratomegilla* (*Megilla*) *maculata*, DeG., and *Cycloneda sanguinea*, L. Yellow cane mosaic, which is carried by *Aphis maidis*, Fitch (*adusta*, Zehnt.), was satisfactorily combated by selection of the material for planting. In some places, rice was seriously attacked by bugs, chiefly the Pentatomid, *Mormidea ypsilon*, L. Stored rice was infested by *Sitotroga cerealella*, Ol., and *Calandra oryzae*, L. Coconut palms on heavy clay soil were severely attacked by *Castnia daedalus*, Cram., against which moth no satisfactory measure has been found. Another coconut pest, the Dynastid, *Strategus aloeus*, L., was dealt with by extracting it from the root-collar with a wire hook.

Marelli (C. A.). **La tucura en la provincia de Buenos Aires.** [*Trigonophymus arrogans* in the Province of Buenos Aires.]—*La Chacra*, i, no. 6, pp. 35–38, 4 figs. Buenos Aires, April 1931. [Recd. December 1931.]

Measures that may be suitable against the grasshopper, *Trigonophymus arrogans*, Stål, in Argentina, are discussed, and various kinds of barriers and poison-baits that have proved of value against other Orthoptera are suggested.

Dustan (G. G.). **A handy Type of Oviposition Cage.**—*Canad. Ent.*, lxiii, no. 12, pp. 273–275, 2 figs. Orillia, Ont., December 1931.

The cage described is a cylinder, 18 ins. high and 9 ins. in diameter, made of galvanised wire screening (18-mesh). It is open at the bottom and is fitted into a square box 3 ins. deep and of the same lateral dimensions as the diameter of the cage, filled with sand which can be kept moist as required. The chief feature of the cage is rapid opening and closing, which is secured by the fitting of a strip of lightning fastener, running almost from top to bottom of one side and sewn to the bent back edges of an opening in the wire. The top consists of a disk of wire screening, about 4 inches wider than the cage, the edges of which are pinched back around a circle with a diameter 1 inch longer than that of the cage, forming a saucer-like lid with overlapping sides. It is pinched round the rim of the cage and oversewn with strong cotton all round through the three thicknesses of wire, the thread passing through the side of the cage about $\frac{3}{8}$ inch from its upper edge. The sewn portion is finally bent sharply inward. Moisture is supplied by means of an outside water-bottle and a strip of dental

cotton. The flexibility of the cage allows for the opening to be stretched to admit a flower-pot or other container 6 ins. in diameter when a 1 ft. strip of fastener is used. The cage has been successfully employed for the oviposition of the oriental peach moth [*Cydia molesta*, Busck] and other insects.

Dongé (E.) & Estiot (P.). **Les insectes et leurs dégâts.**—2nd edn., f'cap 8vo, cclxxxvi+148 pp., 96 col. pls., 210 figs. Paris, Paul Lechevalier, 1931. Price *Fr.* 50.

This second edition of a work already noticed [*R.A.E.*, A, x, 376] has been revised by E. Séguy. In particular, the section dealing with the biology and classification of insects has been entirely rewritten to include the results of recent research, and information dealing with insecticides and other control measures has been revised and considerably extended.

Regnier (R.). **L'organisation moderne de la protection des végétaux d'après l'example de quelques grands pays.**—*Ann. Epiphyties*, xvii, no. 2–3, pp. 113–247, 34 figs., numerous refs. Paris, 1931.

An account based on personal observations made in each of the countries concerned is given of the respective organisations at present functioning in the United States, England, Germany, Czechoslovakia, Holland and Belgium for the protection of plants from pests; and suggestions are laid down for the inauguration of a national service for plant protection in France that shall co-operate with the colonial services. The principles suggested as a basis for the scheme are: a central governing body controlling both research and practical work; separation of the botanical and zoological sections for research and fusion of these two sections as regards application; independence of the scientific staff in so far as this is compatible with the national interest; intensification of research; extension of the application departments; development of the section dealing with the collection and review of publications; and the union of the national service with the systematic and general-biological services on the one hand and with the colonial service on the other.

Ross (H.). **Praktikum der Gallenkunde (Cecidologie).** [A practical Handbook on Galls.]—Med. 8vo, x+312 pp., 181 figs. Berlin, J. Springer, 1932. Price *M.* 24; bound, *M.* 24·60.

The greater part of this introduction to the study of galls on plants deals with those produced by insects and mites. The material is arranged in accordance with the complexity of the gall, beginning with those of a simple type. The examples are mostly taken from galls in Central Europe. A chapter deals with the collection and preservation of galls and with the breeding and identification of the agents causing them; and a bibliography of 7 pages is appended.

Schmidt (E.). **Auftreten von Speckkäferlarven in landwirtschaftlichen Futtermitteln.** [The Occurrence of Lard Beetle Larvae in agricultural Food Materials.]—*Prakt. Bl. Pflanzenb.*, ix, no. 9–10, pp. 193–195, 1 fig. Freising, 1932.

Larvae of *Dermestes lardarius*, L., have been found in Bavaria in an agricultural foodstuff containing 30 per cent. fish-meal and 70 per cent. bone-meal, apparently a new food record for this beetle.

THIEM (H.). **Mittelprüfung gegen** *Eulecanium corni* **an Zwetsche.** [Tests of Insecticides against *Lecanium corni*.]—*NachrBl. deuts. PflSchDienst*, xi, no. 12, pp. 97–98. Berlin, December 1931.

The establishment of standard requirements for tar-distillates [*R.A.E.*, A, xviii, 183] has enabled reliable tests to be made as to the strengths requisite for the effective control of *Lecanium* (*Eulecanium*) *corni*, Bch., which is a serious pest of plums in Germany and other parts of Central Europe. The results of 40 tests show that 100 per cent. mortality was achieved by spraying with two proprietary brands at 10 and 8 per cent. strengths respectively. The same result was obtained with a 5 per cent. solution of soft soap made with cottonseed oil, which was applied in mid-April.

JANCKE (O.). **Ein neues ungiftiges Ködermittel zur Bekämpfung von Kirschblütenmotte und Kirschfliege.** [A new non-poisonous Bait for combating the Cherry Blossom Moth and Cherry Fly.]—*NachrBl. deuts. PflSchDienst*, xi, no. 12, pp. 99–100. Berlin, December 1931.

In further investigations in Germany on the control of the cherry blossom moth, *Argyresthia ephippiella*, F. [*cf. R.A.E.*, A, xviii, 180], a bait-spray of 2 per mille Polvosol (a proprietary insecticide containing derris) and 4 per cent. molasses (50 per cent. sugar) gave excellent results against the adults. In the laboratory a mortality of 80 per cent. on the third day after spraying was obtained with this concentration of insecticide, higher or lower concentrations being less successful. It is probable that a second or third application would increase the effect. Only about a pint of spray was required for each tree, so that the cost was low. In experiments with the beet fly [*Pegomyia hyoscyami*, Panz.], a mortality of 80 per cent. was attained in four days, with concentrations of insecticide of 1 per cent. and 1 per mille. These results suggest that the spray would be of value against the cherry fly [*Rhagoletis cerasi*, L.].

MÜLLER (K. R.). **Ueber die Drehherzkrankheit des Kohls, verursacht durch die Gallmücke** *Contarinia torquens* **de Meij.** [The Deformed Heart Disease of Cabbages caused by the Gall-midge, *C. torquens*.] —*Fortschr. Landw.*, vi, pp. 496–498, 1931. (Abstract in *Zbl. Bakt.*, (2) lxxxv, no. 4–10, p. 173. Jena, December 1931.)

Feeding by the larvae of the gall-midge, *Contarinia torquens*, de Meij., in the leaf-stems of the heart-shoots of cauliflowers and similar crucifers in Germany results in the affection known as deformed heart. This is often associated with decay due to fungi or bacteria. Crop rotation and intensive soil cultivation, the use of repellents to prevent oviposition on the plants, and spraying to kill the young larvae are the measures advocated.

SPRENGEL (L.). **Ueber zwei Hyperparasiten von** *Aphelinus mali* **Hald.** [On two Hyperparasites attacking *A. mali*.]—*Anz. Schädlingsk.*, vii, no. 11, p. 130. Berlin, November 1931.

Two Pteromalids, *Asaphes vulgaris*, Wlk., and *Pachyneuron aphidis*, Bch., have been bred in Germany from *Aphelinus mali*, Hald., used for the control of the woolly apple aphis [*Eriosoma lanigerum*,

Hausm.], this being apparently the first record of any parasites of this Aphelinid in Europe. They seem to be very much less numerous than their host.

Gleisberg (W.) & Mentzel (F.). **Methoden der Laboratoriumsprüfung von Raupenleimen.** [Methods for Laboratory Tests of Banding Adhesives.]—*Z. Pfl Krankh.*, xli, no. 11, pp. 552–587, 9 figs., 8 refs. Stuttgart, November 1931.

Methods for testing adhesives for banding are described, including an apparatus for spreading the coating, and an improved model of one for testing adhesiveness [*R.A.E.*, A, xx, 9]. The apparatus used by Avenarius [xix, 615] is criticised. Attention is drawn to the effect of time on the properties of adhesives; the date of manufacture is therefore important.

Speyer (W.). **Welche Insekten finden wir in den Fanggürteln?** [What Insects do we find in Trap Bands?]—*Verbz. Niederelb. Landes-Obstb.-Verb.*, 1931, no. 11, pp. 1–2. Horneburg, 1st November 1931.

Examination of trap bands on fruit trees in Germany showed them to contain many useful insects, including adults and pupae of Hymenopterous parasites and pupae of Syrphids and Tachinids. Such bands should be used only for the control of *Anthonomus pomorum*, L., and *Cydia pomonella*, L., against which their advantages outweigh the destruction of natural enemies.

Zolk (K.). **Einige weniger bekannte Schädlinge, welche im Jahre 1931 massenhaft in Eesti vertreten waren.** [Some less well known Pests, Outbreaks of which occurred in Estonia in 1931.] [*In Estonian.*]—*Mitt. Versuchssta. angew. Ent. Univ. Tartu*, no. 12, 8 pp., 5 figs., 11 refs. Tartus, 1931. (With a Summary in German.)

The following is taken from the author's summary: Owing to the favourable weather conditions prevailing in 1930 and 1931 in Estonia, outbreaks of *Euxoa* (*Agrotis*) *segetum*, Schiff., and *Phaedon cochleariae*, F. (mustard leaf beetle) occurred, as well as of less well known pests, namely, *Depressaria nervosa*, Haw., on cumin, pupation taking place in mid-July and the adults hibernating; *Tortrix paleana*, Hb., which in years of exceptionally favourable weather produces two generations, on timothy grass [*Phleum pratense*] and *Agropyrum repens*; *Phlyctaenia* (*Pionea*) *forficalis*, L., on cabbage in the southern part of the country, two generations occurring in the year; and *Ceuthorrhynchus pleurostigma*, Marsh., the larvae of which caused serious damage to the roots of crucifers, galls being formed about mid-June. The Noctuid, *Charaeas graminis*, L., destroyed all the grass in an area of about 10 acres in a northern district. Pupation took place at the end of June, and the young adults emerged between 15th and 20th July; hibernation occurred in the egg stage. Satisfactory control was obtained by dusting with calcium arsenate, and a meadow that had been manured in the spring with kainit was not infested.

Zolk (K.). **Massenauftreten der Rübenblattwespe (*Athalia spinarum* F.) in Eesti im Jahre 1931.** [Outbreak of *Athalia colibri*, Christ, in Estonia in 1931.] [*In Estonian.*]—*Mitt. Versuchssta. angew. Ent. Univ. Tartu*, no. 11, 7 pp., 6 figs., 6 refs. Tartus, 1931. (With a Summary in German.)

The following is taken from the author's summary: An outbreak of the sawfly, *Athalia colibri*, Christ (*spinarum*, F.) occurred in Estonia for the first time in 1931, when severe damage to all varieties of turnip was caused in southern districts. Swedes were only slightly infested, and other cultivated crucifers were not attacked. Mature larvae of the second generation were present in infested fields in the second half of July, and most of them pupated between 5th and 20th August, only a few hibernating. The adults emerged from 24th August till 18th September, and eggs, which hatched in 11–13 days, were laid at the end of August and beginning of September in the parenchyma along the edge of the leaves. Plants dusted with a mixture of calcium arsenate and talc were considerably less injured, and the rate of mortality of the larvae reached 34 per cent. on the 9th day; a proprietary insecticide, however, proved much more effective.

Malenotti (E.). **L'impiego del Meritolo nella lotta contro le tignole dell'uva e quella del melo.** [The Use of Meritolo against Vine-moths and the Apple Moth.]—*Atti Accad. Agric. Sci. Lett. Verona*, (5) vii, pp. 61–64, 1 pl. Verona, 1930.

An account is given of further successful work with a proprietary calcium arsenate dust, containing 35 per cent. tricalcic arsenate against *Clysia ambiguella*, Hb., on vines and *Hyponomeuta malinellus*, Zell., on apple [*R.A.E.*, A, xviii, 45, 46].

Malenotti (E.). **Un taglia-steli contro la piralide del mais.** [A Spud for Use against the Maize Pyralid.]—*Atti Accad. Agric. Sci. Lett. Verona*, (5) vii, pp. 65–69, 3 pls. Verona, 1930.

The removal of the whole of the maize stubble is now compulsory in North Italy as a measure against *Pyrausta nubilalis*, Hb. [*R.A.E.*, A, xix, 663]. A special spud, which is here described and is a slight modification of that originally suggested by Zwölfer [xvii, 217], is used for this purpose.

Report of the Activities of the Central Hygienic Institute and Organisations dependent on it in 1930. Department of Parasitology. [*In Serbian.*]—*Socijalno-Med. Pregled*, ii, pt. 5, pp. 119–123. Belgrade, 1931.

A section of this report (pp. 119–120) briefly reviews work on insect pests in Jugoslavia during 1930. The biology of a number of species was studied, including *Hyponomeuta malinellus*, Zell., with its parasites and hyperparasites, *Plodia interpunctella*, Hb., in various stored products, *Lasioderma serricorne*, F., in stored tobacco, *Tinea granella*, L., in stored wheat, *Euxoa* (*Agrotis*) *segetum*, Schiff., *Loxostege* (*Phlyctaenodes*) *sticticalis*, L., *Ephestia elutella*, Hb., and *E. kühniella*, Zell. Larvae of *E. kühniella* infesting flour were parasitised by *Microbracon* (*Habrobracon*) *crassicornis*, Thoms., which, it is believed, has not previously been recorded as a factor limiting the development of the pest. Special attention was devoted to a study of the bionomics of the plum scale, *Lecanium corni*, Bch., and to its control [*R.A.E.*, A, xix, 519].

[Frolov-Bagreev (A. M.) & Popov (K. S.).] **Фролов-Багреев (А. М.) и Попов (К. С.). On the Biology of a new Species of a Mite of the Genus** *Histiogaster*. [*In Russian.*]—*Vestn. Vinogr. Vinodel. Vinotorg. S.S.S.R.*, iii, no. 11, pp. 654–657, 2 figs. Odessa, November 1931.

Numerous unidentified mites of the genus *Histiogaster*, resembling *H. carpio*, Kramer, were found in the Crimea in December 1926 infesting the inner side of an empty wine cask that had been stored in a cellar for about a year. Laboratory experiments showed that the mites successfully develop and oviposit in alkaline, neutral and weak acid media, whereas strongly acid ones are unfavourable to them. Most of the individuals submerged in wine, either pure or containing 10 per cent. sugar, did not survive, and all those kept for a month on a piece of oak saturated with 70 per cent. alcohol died. The mites feed on micro-organisms, infusoria and extractive substances of wine.

Zimmermann (A.). **Der Mandelbaum und seine Kultur.** [The Almond Tree and its Cultivation.]—*Beih. Tropenpfl.*, xxviii, no. 1, 116 pp., 11 figs., 5 pp. refs. Berlin, December 1931. Price *M.* 6.

A section (pp. 70–81) of this paper deals with the Arthropod pests recorded on almond in various countries, comprising 4 Tetranychid mites and 85 insects, the greater part of the information being taken from this *Review*.

Williams (F. X.). **Handbook of the Insects and other Invertebrates of Hawaiian Sugar Cane Fields.**—Med. 8vo, 400 pp., 41 pls., 190 figs. Honolulu, Hawaiian Sugar Pl. Ass., Expt. Sta., 1931. Price $3.00.

This handbook is largely a compilation and, although mainly written by Dr. Williams, is based upon the work of the entomological staff of the Hawaiian Sugar Planters' Association over a number of years. An introduction by the late Dr. Muir explains the principles guiding the work of biological control; R. H. van Zwaluwenburg contributes chapters on the soil fauna of sugar-cane fields and on the Nematodes attacking sugar-cane roots; and O. H. Swezey records the introduction of beneficial insects into the Hawaiian Islands. Various bulletins, circulars and reports published by the Hawaiian Sugar Planters' Association and other organisations have also been drawn upon, as well as a number of other papers. There still remains much to be done to elucidate the life-histories of Hawaiian sugar-cane pests, and it is hoped that the present handbook may serve as a basis for future work. A bibliography covering 12 pages is appended.

Jarvis (E.). **Report of Entomologist in charge at Meringa** [1930–31]. —*31st Ann. Rep. Bur. Sugar Expt. Stas. Queensland*, pp. 42–45. Brisbane, 1931.

As a result of the exchange of parasites between Queensland and the Philippine Islands, it has been found that the Scoliid, *Campsomeris aureicollis*, Lep., readily attacks the grubs of the greyback cockchafer [*Lepidoderma albohirtum*, Waterh.] in Queensland and that *C. tasmaniensis*, Sauss., readily oviposits in the grubs of *Lepidiota pruinosa*,

Wied., and *Leucopholis irrorata*, Chevr., the two most destructive cane-grubs in the Philippine Islands. A total of 772 individuals of the Tachinid, *Ceromasia sphenophori*, Villen., were released in sugar-cane fields against *Rhabdocnemis obscura*, Boisd., between 23rd January and 2nd July. Brief notes are given on the general occurrence of insect pests of sugar-cane, but no serious outbreak of any of the major pests was reported during the year.

Mungomery (R. W.). **Report of Assistant Entomologist, Bundaberg.**—*31st Ann. Rep. Bur. Sugar Expt. Stas. Queensland*, pp. 45–47. Brisbane, 1931.

Some of this information on the pests of sugar-cane in Queensland has already been noticed [*R.A.E.*, A, xix, 235; xx, 163]. The situation with regard to the activities of cane-grubs in one district from 1913 to 1930 is reviewed. A table shows that heavy infestations were more or less cyclical, and that one or two years of heavy infestation were usually followed by years of lighter infestation, with a gradual increase or decrease of the pest up to a certain point.

Tests were carried out in February to determine the relative effects of fumigations with orthodichlorobenzene, paradichlorobenzene and carbon bisulphide on the growth of sugar-cane. A dose of 4·5 gm. was injected into the soil on each side of the stool and 4 ins. from it, at a depth of $3\frac{1}{2}$ ins. Orthodichlorobenzene and paradichlorobenzene both appeared to retard the growth of the plant, which tends to produce side-shoots. Treatment with carbon bisulphide merely resulted in a temporary wilting of the leaves a few days after treatment.

In view of the theory that in the Philippines cane-grubs are confined to slightly acid soils [xix, 529], investigations were undertaken to ascertain whether this factor would explain the limited occurrence of the Dynastid, *Pseudoholophylla furfuracea*, Burm., in Queensland. Analyses of samples of many different infested soils showed that infestation occurred between pH values of 4·68–7·80, proving that this species has a wide range so far as acidity or alkalinity is concerned.

Experiments with Fiji disease of sugar-cane resulted in one case of secondary infection apparently transmitted by *Trionymus sacchari*, Ckll. *Aphis maidis*, Fitch, *A. sacchari*, Zehnt., and *Perkinsiella saccharicida*, Kirk, did not transmit the disease.

McDougall (W. A.). **Report of Assistant to Entomologist, Mackay.**—*31st Ann. Rep. Bur. Sugar Expt. Stas. Queensland*, pp. 47–48. Brisbane, 1931.

Inspection of sugar-cane in mill yards and also of standing crops revealed a widespread but light infestation by *Rhabdocnemis obscura*, Boisd., in 1930–31. During the spring, grubs and adults of *Pentodon australis*, Blackb., damaged the cane sets and young shoots, and on low-lying ground somewhat similar injury is caused by Elaterids. The latter seldom attack the eyes until they are swollen, but they kill the young shoots and bore into the underground parts of the larger ones, causing dead heart. Three species occur, but almost all the damage is due to one, which belongs to the genus *Lacon*. The larvae are not found in cultivated soils having a pH higher than 5·5 (water solution). In the laboratory, however, in the course of 6 months they have reached the adult stage in soils with a pH of up to 7. The life-cycle

occupies at least two years. The larvae are found in the top 2 or 3 ins. of the moist soil during August-October. Pupation of the most important species commences in early October, the depth depending on the moisture conditions of the soil. The pupal stage lasts 14–17 days. Three other species of Elaterids, which include *L. assus*, Cand., have been collected from higher fields, but they are not known to have damaged cane in this district.

ALDEN (C. H.). **Experimental Results, Fruit Pest and Parasite Laboratory, 1927–1931.**—*Bull. Georgia St. Bd. Ent.*, no. 76, 22 pp., 2 charts. Atlanta, Ga., February 1932.

The results of experimental work in the control of various insect pests by insecticides and in the breeding and colonisation of parasites, carried out in Georgia during the five-year period 1927–1931, are briefly reviewed. The parasites bred and colonised in 1930 and 1931 included *Trichogramma minutum*, Riley [*cf. R.A.E.*, A, xix, 490, 604], and *Macrocentrus ancylivora*, Roh., of which over 5,000 were imported from New Jersey and liberated in peach orchards for the control of the larvae of the oriental peach moth [*Cydia molesta*, Busck].

LEBERT (C. D.). **Arizona Insect Pest Report of 1929–1930.**—*21st–22nd Rep. Arizona Comm. Agric. Hort. 1929–31*, pp. 54–64. [Phoenix, Ariz., 1931.]

Notes are given on a large number of insect pests observed in Arizona during 1929 and 1930. Those recorded in 1929 include: *Epicauta corvina*, Lec., on beans; *Chaetocnema ectypa*, Horn, on maize; *Blapstinus pimalis*, Csy., on watermelons; *Trichobaris mucorea*, Lec., on potatoes; *Hysteroneura setariae*, Thomas, on plums; *Harrisina brillians*, B. & McD., on vines; *Leptoglossus phyllopus*, L., on pomegranates; and *Cotalpa consobrina*, Horn, on poplars.

Those recorded in 1930 include: *Tegrodera latecincta*, Horn, which defoliated vegetable crops in May, the beetles migrating to the fields from adjacent desert land; *Phlyctaenia rubigalis*, Gn. (*ferrugalis*, auct.), which was responsible for serious injury to violets during the winter; and *Apatides fortis*, Lec., which caused extensive damage to stored mesquite [*Prosopis*] fire-wood. Insects recorded in both years include: *Cotinis texana*, Csy., on peaches, apricots, figs and grapes; *Tibicen cinctifera*, Uhler, on *Citrus*; *Chionaspis etrusca*, Leon., which was abundant in one locality on *Tamarix*, but was controlled to some extent by the Coccinellid, *Chilocorus cacti*, L.; and termites, particularly *Heterotermes aureus*, Snyder, which caused serious damage to timber, etc., in dwellings.

LEBERT (C. D.). **The Cottony Cushion Scale in Arizona.**—*21st–22nd Rep. Arizona Comm. Agric. Hort. 1929–31*, pp. 97–98. [Phoenix, Ariz., 1931.]

Since its discovery in Arizona in 1926, *Icerya purchasi*, Mask., has been annually held in check by liberations of *Rodolia cardinalis*, Muls. This Coccinellid, however, cannot survive the winter, and owing to the fact that a few of the Coccids escape destruction, slight infestations occur each year.

Gil Collado (J.). **Notas sobre Taquínidos españoles (Dipt.). I. Algunas especies parásitas de orugas de El Escorial.** [Notes on Spanish Tachinids. I. Some Species parasitising Lepidopterous Larvae at the Escurial.]—*Eos*, vii, no. 3, pp. 349–354, 4 figs. Madrid, 1931.

A number of Tachinids are recorded, with morphological notes on some of them. They include *Compsilura concinnata*, Mg., bred from *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorrhoea*, L.), *Sturmia atropivora*, R.-D., from *Sphinx pinastri*, L., *Actia tibialis*, R.-D., from *Prosopolopha jourdanaria*, Serres, and *Winthemia quadripustulata*, F., and *Erythrocera scutellaris*, R.-D., both from *Abraxas pantaria*, L.

Reichert (A.). **Rosenschädlinge.** [Rose Pests.]—*Die kranke Pflanze*, viii, no. 11–12, pp. 165–167, 1 pl. Dresden, 1931.

In Saxony, *Blennocampa pusilla*, Klug, which apparently only attacks rose, occurs in May and June. The oviposition of this sawfly produces a leaf-curl, representing a transition to a true leaf-gall, in which the larva feeds. The latter hibernates in the ground in the prepupal stage, pupating in the spring. The larvae of another sawfly, *Emphytus cinctus*, L., which probably has two generations a year, are to be found on rose throughout the growing period. They should be shaken off or killed by a spray directed against the lower surface of the leaves. Pupation usually takes place in a cavity hollowed out in a branch that has been pruned.

Dufrénoy (F.). **Insecticides et anticryptogamiques, d'après les récents travaux étrangers.**—*Rev. Bot. appl.*, xi, nos. 122–124, pp. 825–831, 904–916, 978–990, 30 refs. Paris, 1931.

This review from the literature of recent work in the development outside France of insecticides and fungicides deals in the first place with the toxicity and physical properties of insecticides in general, and subsequently with the individual groups, including sulphur, lime-sulphur, Bordeaux mixture, arsenical compounds, fluosilicates, soaps, mineral oils, nicotine and pyrethrum.

Priesner (H.). **On the Biology of *Chrysomphalus ficus* Ril. (Hem., Cocc.) with Suggestions on the Control of this Species in Egypt.**—*Bull. Minist. Agric. Egypt*, no. 117, 19 pp., 5 refs. Cairo, 1931.

An account is given of the results of observations in Egypt on the bionomics of *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.), where it is the most injurious Coccid attacking *Citrus*. The data given only differ in minor details from those already noticed [*cf. R.A.E.*, A, xvi, 669; xvii, 649]. There are four generations a year, the first occurring from the end of February or early March to early or mid-June, the second from early or mid-June to about the end of July, the third from late July or the first half of August to mid-September, and the fourth from the middle or end of September to the end of February. All stages are present throughout the year, but males emerge only occasionally during the winter. Since egg-laying is extended over a period of about a month, one female laying from 50–80 eggs at the rate of 2–3 a day, there is a considerable overlapping of generations later on in the season. The eggs when deposited have already made much progress in their development and hatch within 5 days, though actual viviparity has not been observed to occur. The mortality among the young larvae is high, especially during the winter, owing probably to unfavourable temperature. Some, however, die owing to their inability

to free themselves from the egg-shell, or to force their way from under the mother scale. In February 1929 a mortality of up to 87 per cent. was observed. The death of all stages during the winter is further increased by a considerable falling of the foliage of evergreen plants as a result of infestation, this being true, not only of *Citrus*, but also of other plants, especially *Ficus nitida*. The adult females die on having completed their egg-laying. Such females, which can be recognised by their shrivelled abdomens and discoloured bodies, should be taken into consideration when the results of fumigation are being calculated. The development of the larvae and the morphological changes that occur before the adult stage is reached are discussed. The first instar larvae (the only active stage of the Coccid) may migrate for some distance and thus spread from one tree to another if the branches touch.

A list is given of preferred and secondary food-plants of the scale, and the nature of the damage it causes is described. Various factors influencing its incidence are reviewed; healthy trees are usually less infested than weak ones growing under neglected conditions.

The natural enemies observed were the Coccinellids, *Chilocorus bipustulatus*, L., *Exochomus flavipes* var. *nigripennis*, Erichson, and *Pharoscymnus varius*, Kirsch, the Nitidulid, *Cybocephalus flaviceps*, Reitt., *Chrysopa vulgaris*, Schn., several species of Conipterygids, *Haplothrips cahirensis*, Tryb., and the parasites, *Aphelinus chrysomphali*, Mercet, and *Aspidiotiphagus lounsburyi*, Berl. & Paoli. Methods of control suggested include improvement of conditions under which *Citrus* is grown and attempts to obtain resistant varieties, as well as the introduction of additional parasites, particularly *Comperiella bifasciata*, How., and *Casca* spp.

Jack (R. W.). *Ephestia elutella*, **Hb., as affecting the Southern Rhodesian Tobacco Export Trade.**—*Rhodesia Agric. J.*, xxix, no. 1, pp. 32–36. Salisbury, January 1932.

The Pyralid, *Ephestia elutella*, Hb., has recently become a serious pest of stored tobacco in Britain [*R.A.E.*, A, xx, 1], infesting both Virginia and Turkish leaf, with a preference for bright or medium varieties. It has recently been found in Salisbury attacking both tobacco and imported chocolate, but has not been observed elsewhere in Southern Rhodesia, nor in Northern Rhodesia or Nyasaland. When a thorough inspection of the port of Beira was made in 1929, no possible permanent breeding-places could be found [xviii, 532], and legislation has enforced cleansing measures in exporting warehouses [xix, 509], none of which seem to be infested at the present time. Cross infestation may, however, occur if infested consignments come to the port. It is probable that the chief danger lies with tobacco; evidence indicates that this is a comparatively new food, and a strain of this moth adapted to feeding on tobacco has obviously been established in various countries [*cf.* xx, 1]. The mingling in ships of tobacco from various countries also gives ample opportunity of cross infestation occurring on the voyage to England. It is thought that if legislation were passed in Northern Rhodesia and Nyasaland similar to that in force for Southern Rhodesia, the risk of contamination by this insect or by *Lasioderma serricorne*, F., at Beira or on the voyage to England would be reduced to a minimum. In store rooms and farms where tobacco is stored for a short period only, simple cleanliness and the elimination of waste tobacco has ensured at least approximate freedom from infestation. In central warehouses where storage is more prolonged, additional protection has been obtained by wrapping the bales

in tarred paper immediately the tobacco leaves the Proctor machine, the use of which is considered an effective cleansing process as regards the moth. If the tarred paper is in one piece and properly sealed, it is probable that complete protection against both *E. elutella* and *L. serricorne* may be secured, though further experiments are necessary. Even wrapping the bales in paper without sealing has given considerable protection.

Studies of the life-history of *E. elutella* at Salisbury indicate that occasional individuals may have a very prolonged larval and prepupal stage, the maximum recorded to date being 365 days from hatching to pupation. The non-feeding prepupal stage has in many individuals lasted from April to August, and periods of 300 days have also been recorded. Development is apparently resumed with the first warm days after the winter. It is therefore theoretically possible for infestation of a storeroom to persist for nearly a year after all sources of food have been removed. Washing the walls, etc., of storehouses with hot lime wash is therefore advocated, though its action on the resting larvae has not been determined. The speedy despatch of tobacco is one of the most important factors in control of the insect.

PAPERS NOTICED BY TITLE ONLY.

STARK (V. N.). **Старк (В. Н.). Caucasian Representatives of the Genus *Hylesinus* (Coleoptera, Ipidae).** [Including *H. botscharnikovi*, sp.n., from Transcaucasia on ash.] [*In Russian*].—*Bull. Inst. Controlling Pests & Diseases*, no. 1, pp. 81–84. Leningrad, 1931. (With a Summary in German.)

TARBINSKIĬ (S. P.). **Тарбинский (С. П.). A Revision of the Palaearctic Species of the Genera *Gomphocerus* Thunb. and *Dasyhippus* Uvar. (Acrididae).** [*In Russian.*]—*Bull. Inst. Controlling Pests & Diseases*, no. 1, pp. 127–157, 17 figs., 2 maps, 123 refs. Leningrad, 1931.

PAILLOT (A.). **Les variations morphologiques du bacille symbiotique de *Macrosiphum tanaceti*.**—*C.R. Acad. Sci. Fr.*, cxciii, no. 23, pp. 1222–1224, 1 fig. Paris, 1931.

GEORGEVITCH (J.). **Etude des Termites de Yougoslavie.** [*In Serbian.*] —*Glas. srpsk. kralj. Akad.*, lxxi, pp. 1–72, 4 pls., 3 figs., 27 refs. Belgrade, 1931.

HODGE (C.). **Growth and Nutrition of *Melanoplus differentialis* Thomas (Orthoptera : Acrididae). I. Growth on a satisfactory mixed Diet and on Diets of single Food Plants (Abstract).**—*Anat. Rec.*, li, no. 1, suppl., pp. 34–35. Philadelphia, Pa., 25th November 1931.

NELSEN (O. E.). **The Development of the Ovary in the Grasshopper, *Melanoplus differentialis* (Abstract).**—*Anat. Rec.*, li, no. 1, suppl., p. 76. Philadelphia, Pa., 25th November 1931.

MALENOTTI (E.). **Un nuovo e sicuro mezzo di lotta contro le grillotalpe.** [The Zinc Phosphide Bait, a new and reliable Measure against *Gryllotalpa gryllotalpa*, L., in Italy.]—*Atti Accad. Agric. Sci. Lett. Verona*, (5) vii, pp. 57–60. Verona, 1930. [*Cf. R.A.E.*, A, xviii, 45, 335 ; xix, 184, etc.]

ACQUA (C.). **Contributo alla conoscenza della natura degli ultravirus. Ricerche sulla malattia della poliedria negli insetti (*Bombyx mori* L.).** [A Contribution to the Knowledge of the Nature of Ultraviruses. Researches on Polyhedral Disease in Insects (*B. mori*).]—*Boll. R. Staz. sperim. Gelsic.*, x, no. 5–6, pp. 159–201. Ascoli Piceno, 1931.

Mercet (R. G.). **Afelinidos paleárticos (Hym. Chalc.). 8a nota.**—*Bol. Soc. esp. Hist. nat.*, xxxi, no. 9, pp. 659–669, 13 figs. Madrid, 15th December 1931.

Ceballos (G.). **Estudios sobre Icneumónidos de España. II. Subfamilia Cryptinae (Tribu Cryptini).**—*Trab. Mus. Cienc. nat.*, Ser. Zool. no. 56, 206 pp., 104 figs., 23 refs. Madrid, 1931.

Börner (C.). **Mitteilungen über Blattläuse.** [Communications on Aphids, including two new species from Germany.]—*Anz. Schädlingsk.*, vii, no. 11, pp. 128–130. Berlin, November 1931. [*Cf. R.A.E.*, A, xx, 7, etc.]

Lindinger (L.). **Literaturstudie über einige Blattlausgallen (Aphid.).** [A Study of the Literature of some Aphid galls.]—*Ent. Z.*, xlv, no. 20, pp. 273–279, 46 refs. Frankfurt a. M., 22nd January 1932.

Orfila (R. N.). **El Genotipo de *Lachnus* Burm. (Hemip.-Aphid.).** [*L. lapidarius*, F., designated as Genotype.]—*Rev. Soc. ent. argent.*, iii, no. 4–5, pp. 249–250, 9 refs. Buenos Aires, 1931.

Miller (F. W.). **Study of the Reproductive System of the Male and Female (oviparous) Cocklebur Aphid.** [? *Hyadaphis xanthii*, Oestl.]—*Proc. Pennsylvania Acad. Sci.*, v, pp. 75–79, 10 figs., 3 refs. Harrisburg, Pa., 1931.

Gillette (C. P.) & Palmer (M. A.). **The Aphidae of Colorado. Part I.**—*Ann. Ent. Soc. Amer.*, xxiv, no. 4, pp. 827–934, 100 figs. Columbus, Ohio, December 1931.

Crosby (C. R.) & Chupp (C.). **The Control of Diseases and Insects affecting Vegetable Crops.**—*Cornell Extens. Bull.*, no. 206 revd., 99 pp., 11 figs. Ithaca, N.Y., N.Y. St. Coll. Agric., November 1931. [*Cf. R.A.E.*, A, xix, 366.]

Dutton (W. C.), Hutson (R.) & Muncie (J. H.). **Spraying Calendar.**—*Spec. Bull. Michigan Agric. Expt. Sta.*, no. 174 revd., 41 pp. East Lansing, Mich., February 1931. [*Cf. R.A.E.*, A, xvi, 387.]

Roark (R. C.). **Review of United States Patents relating to Pest Control** [issued July-December 1931].—iv, nos. 7–12; 15, 12, 12, 10, 9, 14 pp. multigraph. Washington, D.C., U.S. Dept. Agric., Bur. Chemistry & Soils, 1931.

Payne (N. M.). **Duration of the pupal Stage of *Tenebrio molitor* Linnaeus at constant and at alternating Temperatures (Coleop. : Tenebrionidae).**—*Ent. News*, xliii, no. 1, pp. 6–7, 1 ref. Philadelphia, Pa., January 1932.

Aldrich (J. M.). **North American two-winged Flies of the Genus *Spathimeigenia*, with Descriptions of five new Species.**—*Proc. U.S. Nat. Mus.*, lxxx, art. 11, no. 2911, 10 pp. Washington, D.C., 1931.

Aubertin (D.). **A Tachinid Fly** [*Podomyia atkinsoni*, sp. n.] **parasitic on the Bee-hole Borer of Teak** [*Xyleutes ceramica*, Wlk., in Burma].—*Stylops*, i, pt. 2, pp. 35–36, 1 fig. London, 15th February 1932.

Hutson (J. C.). **Report on the Work of the Entomological Division.**—*Adm. Rep. Dir. Agric. Ceylon 1930*, pp. D70–77. Colombo, October 1931. [See *R.A.E.*, A, xix, 397.]

Yen (Chia-hsien). **A preliminary List of East China Aphididae.** [30 species with food-plants.]—*Peking Nat. Hist. Bull.*, vi, pt. 2, pp. 61–70. Peiping, December 1931.

Yendo (T.). **On the Life-History of *Anomala* (*Euchlora*) *cuprea* Hope.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iii, pp. 187–188. Tokyo, 1931.

Kuwana (I.). **On the *Aclerda* of Japan.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iii, pp. 229–231. Tokyo, 1931.

Willaume (F.). **Pratique du contrôle contre les ravageurs souterrains.**—*Rev. Zool. agric.*, xxix, nos. 6–8, pp. 96–98, 112–114, 128–132; xxx, no. 2, pp. 24–34; no. 3, pp. 37–41; no. 8, pp. 128–130; no. 10, pp. 156–164; no. 11, pp. 165–173, 3 pls., 5 figs., numerous refs. Bordeaux, 1930–31.

In continuation of a previous series of papers [*R.A.E.*, A, xviii, 23], the various measures employed for the control of insects and other pests attacking the underground parts of cultivated plants or passing a portion of their existence in the soil are reviewed. The initial principle is laid down of directing control measures against the aerial form of the pest wherever possible. The measures adopted include cultivation of the soil and the use of fertilisers; control of the aerial forms by hand-picking, traps, or insecticides; the use of repellents or protective barriers; the disinfection of bulbs; and lastly the destruction of the pests during the stage in which they are actively injurious, by collection, the use of poison baits, or treatment of the soil by means of physical and chemical agents. Details are given of the various chemicals used for soil treatment, the relative merits of calcium cyanide and carbon bisulphide being discussed, and a table shows the measures suitable for each class of subterranean insect.

Bruneteau (J.). **La respiration et la mort apparente chez le doryphore.**—*Rev. Zool. agric.*, xxx, no. 10, pp. 149–155, 2 figs., 8 refs. Bordeaux, October 1931.

The respiratory system of *Leptinotarsa decemlineata*, Say, is described in detail, and its method of breathing and habit of simulating death are discussed. Tables are given to show the resistance of the adult to varying periods of submergence in fresh and salt water. It recovers at the end of 2 hours from a submergence of 24 hours in fresh water or one of 19 in salt. The larvae, however, die quickly when they are submerged. In nature the beetles can float for considerable periods without the water reaching their abdominal stigmata. They were observed in the Dordogne and Gironde region to have survived hibernation in soil that had been entirely under water for the greater part of the winter, probably because air imprisoned in the interstices of the hibernating chamber sufficed for them.

Miles (H. W.). **On the Garden Pebble Moth, *Pionea forficalis*, L.**—*North Western Naturalist*, vi, pt. 4, pp. 200–207, 2 pls., 17 refs. Arbroath, December 1931.

Phlyctaenia (*Pionea*) *forficalis*, L., all stages of which are described, is common in Britain, attacking cabbage, turnip and other crucifers. An account is given of its bionomics and control as a result of observations since 1923. The larvae are seldom sufficiently numerous on field crops to cause serious injury; they usually occur on the plants near hedges and especially near buildings, walls and fences. Severe damage may, however, be caused to market garden crops, the larvae infesting the heads of young transplanted cauliflowers and broccoli and rendering the older plants unfit for use. They usually destroy the centres of cabbages and may web the young leaves together.

There are two generations a year, moths being on the wing during May–June and August–September; in 1926 in one district a partial third was observed. The moths become active at dusk, and numbers

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have been caught at lights. Clusters of 2–17 eggs are laid 5–11 days after emergence and hatch in 8–10 days. The larvae of the first generation mature in 19–22 and those of the second in 25–40 or more. The pupal period is passed in a cocoon at a depth of $\frac{1}{2}$–$1\frac{1}{2}$ ins. in the soil, the adults emerging in 20–24 days. The larvae that mature in the autumn hibernate in the cocoons and pupate in the spring. In experiments the adults had great difficulty in emerging from pupae at a depth of over $1\frac{1}{2}$ ins., and it is suggested that the top 3 ins. of soil should be buried during cultural operations. When plants newly set out are infested, a spray of soap and nicotine or one containing derris extract could be used, provided that the centres of the plants are loose and open, the material being forced well into them and applied to the lower surface of the leaves. Where seed beds are infested, the plants could be tied in bundles when drawn out for setting and dipped in a dilute insecticide such as nicotine and soap or a mixture of 1 oz. lead arsenate powder and 3 gals. water with a small quantity of calcium caseinate as a spreader. It is important to undertake control measures in June against the larvae of the first generation.

Numbers of *Apanteles picipes*, Bch., were reared from the larvae of the spring brood in 1924 and 1925. This Braconid has two generations a year, the second hibernating in cocoons within those of the host.

Munro (J. W.). **The biological Control of Forest Insects.**—*Emp. For. J.*, x, no. 2, pp. 209–214. London, 1931.

The author briefly discusses the problems affecting the possibility of biological control of forest insects by means of their natural enemies. In the case of such pests as borers, the abundance of which largely depends on pathological conditions of the trees, this method is considered to have little prospect of success. It might in special cases be employed against defoliating insects, but in general it is " a complex, difficult and often slow method, and too high hopes of immediate results should not be looked for from it."

van Emden (F.). **Zur Kenntnis der Morphologie und Oekologie des Brotkäfer-Parasiten** *Cephalonomia quadridentata* **Duchaussoy.** [Contribution to a Knowledge of the Morphology and Bionomics of *C. quadridentata*, a parasite of *Sitodrepa panicea*, L.]—*Z. Morph. Oekol. Tiere*, xxiii, no. 3–4, pp. 425–574, 1 pl., 53 figs., 3 pp. refs. Berlin, 14th November 1931.

The Bethylid, *Cephalonomia quadridentata*, Duchaussoy, wingless females of which have been found in Germany in granulated malt, is a parasite of *Sitodrepa panicea*, L. Detailed descriptions of the morphology of all stages are given.

The winter is passed by the wingless females in the cocoons of the host where the humidity conditions are favourable, and oviposition begins in spring. Females searching for a host can penetrate through minute apertures. The host larva or pupa is first paralysed by the female through the cocoon, an opening is then made, and the parasite enters to lay from 1–11 eggs on the body of the host. On the average 40 eggs are laid by a female, which thus parasitises about 10 hosts. Besides *S. panicea*, larvae of *Lasioderma serricorne*, F., *Niptus hololeucus*, Fald., and *Ptinus tectus*, Boield., were accepted as hosts in experiments. The egg stage lasts 4–13 days, the larval 9–28·5 and the pupal 12–26. Eggs laid by an unfertilised female always

produce males; these males, however, can fertilise a female. Calculations of the intensity of reproduction of the parasite indicate that the progeny of one female would be able to exterminate that of 2·4 females of the host during one year, and of 9·7 females in two years.

WEBER (H.). **Lebensweise und Umweltbeziehungen von** *Trialeurodes vaporariorum* **(Westwood) (Homoptera-Aleurodina). Erster Beitrag zu einer Monographie dieser Art.** [Biology and environmental Relations of *T. vaporariorum*. First Contribution to a Monograph of this Species.]—*Z. Morph. Oekol. Tiere*, xxiii, no. 3–4, pp. 575–753, 59 figs., 3 pp. refs. Berlin, 14th November 1931.

This paper represents the biological part of a complete monograph of *Trialeurodes vaporariorum*, Westw., and comprises a detailed treatment of the development, behaviour, ecological relations and epidemiology of the insect, based on the author's investigations in Germany and on the literature. It is only possible here to give some of the outstanding points.

The mortality of the eggs, which are laid on leaves of greenhouse plants, depends mainly on the state of the food-plant. Thus a temperature that in itself is not injurious to them may influence their mortality indirectly through its effect on the plant. Humidity acts on the eggs only in this indirect way. The larvae are more susceptible to low humidity, particularly when they are not covered by the waxy secretion, which does not appear until after food has been taken. The fourth larval stage is more resistant to external conditions and can survive even on fragments of leaves, the optimum combination being 22° C. [71·6° F.] and 80 per cent. relative humidity. The sexual maturation of adults depends on the temperature conditions, mainly as they affect the rate of feeding and metabolic changes. The optimum for oviposition is between 25 and 30° C. [77–86° F.], when up to 2 eggs a day can be laid. As regards selection of places for oviposition, females are guided, not by the colour of leaves, but by the intensity of light. The chemical attraction is important only for retaining the female on the plant, and does not act at a distance.

The natural enemies of *T. vaporariorum* observed include a species of *Encarsia*, probably *formosa*, Gah., and the fungi, *Cephalosporium lefroyi* and *Cladosporium sphaerospermum*.

HEYMONS (R.) & VON LENGERKEN (H.). **Studien über die Lebenserscheinungen der Silphini (Coleopt.).** [Studies on the Bionomics of Silphini.] **viii.** *Ablattaria laevigata* **F.**—*Z. Morph. Oekol. Tiere*, xxiv, no. 2, pp. 259–287, 13 figs., 18 refs. Berlin, 11th January 1932.

Full details are given of the morphology and biology in Germany of *Ablattaria laevigata*, F., of which both the adult and larva feed on snails of the genus *Helix*.

ZACHER (F.). **Beiträge zur Kenntnis phytophager Milben.** [Contribution to a Knowledge of phytophagous Mites.]—*Zool. Anz.*, xcvii, no. 7–8, pp. 177–185, 11 figs. Leipzig, 15th January 1932.

These notes on mites in Germany include descriptions of *Paratetranychus nuptialis*, sp. n., from myrtle and *P. brevipilosus*, sp. n., from

pine. A mite occurring on copper beech, the identity of which has long been doubtful, is now found to be *Tetranychus* (*Epitetranychus*) *fagi*, Zach. *Tetranychus tiliarius*, Herm. (*telarius*, auct.) hibernates at the foot of lime trees, returning to the trees in April or May.

Amtliche Pflanzenschutzbestimmungen. [Official Regulations on Plant Protection.]—*NachrBl. deuts. PflSchDienst*, Beilage, iv, no. 1, pp. 1–46. Berlin, 1st January 1932.

This part includes regulations prohibiting the importation of living plants or fresh parts of them into Germany from various countries as a precaution against the introduction of the San José scale, *Aspidiotus perniciosus*, Comst. Fresh fruits may be admitted after examination at specified points, but fruit from the United States and Canada must also be found free from infestation by the apple maggot, *Rhagoletis pomonella*, Walsh.

[Rafes (P.M.).] **Рафес (П. М.). Technical Methods and Organisation of the Control of the Migratory or Asiatic Locust** (*Locusta migratoria* **L.).** [*In Russian.*]—[*Bull.*] *Sev.-Kavk. kraev. Otd. gosud. vsesoyuzn. Ob'ed. Bor'be Vredit. sel'sk. lesn. Khoz.* [*Bull. N. Caucas. Reg. Sect. Govt. All-Union Soc. Cont. Agric. For. Pests*], Series A, no. 4, 73 pp., 15 figs., 21 refs. Rostov-on-Don, 1931.

Detailed technical instructions are given for the application of the usual control measures and for dusting by aeroplanes. The latter method should be adopted only when the infested area is sufficiently large, since it is not economical if many small areas have to be treated. One aeroplane can dust over 12,000 acres during a single campaign, from $1\frac{1}{2}$ to 4 lb. of calcium arsenate, or $2–3\frac{1}{2}$ lb. of sodium arsenite being sufficient for about an acre.

[Nenyukov (D.V.) & Tareeva (A.I.).] **Ненюков (Д. В.) и Тареева (А. И.). The Non-protein Nitrogen of Insect Blood ; its Variation with Diet and Arsenite Poisoning.** [*In Russian.*]—*Bull. Plant Prot.*, iii, no. 1, pp. 33–38, 2 refs. Leningrad, 1931. (With a Summary in English.)

In experiments relating to the problem of nitrogen exchange in insects, it was found that this process decreased when cockroaches were starved or fed exclusively on carbohydrates or fats, and dropped to a marked extent when they were fed on bread poisoned with arsenicals. This last fact indicates that incomplete poisoning affects the metabolic process in insects and would probably reduce their reproductive power, and it is in agreement with data obtained during a campaign against the cedar moth [*Dendrolimus sibiricus*, Tshtv.] [*R.A.E.*, A, xix, 701], when calcium arsenite was used. Owing to unfavourable weather conditions some of the larvae were incompletely poisoned, and pupated ; some of the pupae, however, did not give rise to adults, and a considerable percentage of moths that emerged had undeveloped wings and either did not oviposit, or only laid about 30 per cent. the usual number of eggs.

[Strachitzkiĭ (K.).] **Страчицкий (К.). On different Sensitiveness of Plant Leaves towards Insectofungicides.** [*In Russian.*] *Bull. Plant Prot.*, iii, no. 1, pp. 51–59, 1 fig., 7 refs. Leningrad, 1931. (With a Summary in English.)

An account is given of laboratory investigations on the varying susceptibility of the foliage of different plants to chemical insecticides. Drops of a 1 per cent. solution of hydrated copper sulphate were placed on leaves, the number of drops that caused scorching being noted. Of the cultivated plants tested, sunflower, apricot, and peach proved to be the most susceptible, whereas apple, pear, cherry, and cherry-laurel (*Prunus laurocerasus*) were not affected. A comparative study of 22 different plants showed that scorching only occurs if the poisonous substance penetrates into the mesophyll of the leaf, penetration depending on the structure of the outer tissues and the thickness of the cuticle and its layers. In sunflower, apricot and peach, the cuticle is very tender and badly developed, and in most cultivated plants it is more developed on the upper than on the lower surface of the leaves. During the summer, the leaves of pears and apples are impenetrable to the commonly used insecticides, unless their surface has previously been injured.

[Mikhaĭlov-Senkevich (Ya.M.).] **Михайлов-Сенкевич (Я. М.). Aeroplane Dusting in Control of the Oak Leaf-roller in the Chuvash Republic in 1928.** [*In Russian.*]—*Bull. Plant Prot.*, iii, no. 1, pp. 61–77, 4 graphs. Leningrad, 1931. (With a Summary in English.)

In view of the severe damage that has been caused for a number of years to oak forests in the Chuvash Republic (western part of the former Kazan Government) by *Tortrix viridana*, L., experiments in aeroplane dusting were carried out between 27th May and 24th June 1928 over an area of about 3,800 acres, more than 10 tons of arsenicals being used. Examination of the trees, which varied in age, some being 300 years old, showed that the upper part of the crown was much more heavily infested than the lower. The dust was applied early in the morning, as after 7–8 a.m. air currents hindered the work. Preliminary laboratory tests on the toxicity of various dusts to the larvae showed lead arsenite to be the most toxic, followed by calcium arsenite, lead arsenate and calcium arsenate in the order given. In the actual work, with dust applied at a rate of about 7–10 lb. per acre, lead arsenite caused an average mortality of over 80 per cent., whereas calcium arsenate gave a mortality of 80 per cent. in a few instances only. Dust released when the leaves were covered with dew adhered much better, 20–60 per cent. of the original quantity being found on the leaves three days later, as compared with only traces on foliage dusted when there was no dew.

[Ugryumov (G. D.) & Vuishelesskaya (N. S.).] **Угрюмов (Г. Д.) и Вышелесская (Н. С.). Insecticide Action of Nicotine Preparations.** [*In Russian.*]—*Bull. Plant Prot.*, iii, no. 1, pp. 115–145. Leningrad, 1931. (With a Summary in English.)

This is a detailed account of experiments on the toxicity of sprays of nicotine sulphate and various extracts of tobacco obtained from different parts of Russia, when tested at equivalent concentrations of

actual nicotine on *Stephanitis* (*Tingis*) *pyri*, F., *Psylla pyri*, L., and various Aphids. Methods of preparing the extracts are briefly described. Laboratory investigations showed that 40 per cent. nicotine sulphate and some of the extracts were about twice as effective as others or as chemically pure nicotine. In the case of the extracts it was found that this does not depend on differences in hydrogen-ion concentration. In field tests the various preparations at a concentration of 0·05 per cent. actual nicotine were much less effective when used alone than when combined with soap at the rate of 1 lb. to 24 gals., and a spray of 1 lb. soap to 6 gals. water was less effective than the weaker soap spray with nicotine. With or without the addition of soap, nicotine sulphate was more effective than the extracts, whereas the lowest rate of mortality was produced by 95–98 per cent. nicotine. When, however, soft water was used, the toxicity of the latter was higher than that of the extracts.

[Petrov (A. D.).] **Петров (А. Д.). Methods of testing the active Substance in the Pyrethrum.** [*In Russian.*]—*Bull. Plant Prot.*, iii, no. 1, pp. 155–158, 1 ref.

[Petrov (A. D.) & Ikonen (E. V.).] **Петров (А. Д.) и Иконен (Е. В.). Content of Pyrethrin in different Species of Pyrethrum.** [*In Russian.*]—*T.c.*, pp. 159–164, 2 graphs, 8 refs. (With a Summary in English.)

[Isachenko (V. B.) & Goritzkaya (O. V.).] **Исаченко (В. Б.) и Горицкая (О. В.). Some Data of toxicological Analysis of the Pyrethrum.** [*In Russian.*]—*T.c.*, pp. 165–174, 8 graphs, 14 refs. Leningrad, 1931. (With a Summary in English.)

In the first of these papers notes are given on methods of estimating the toxicity of pyrethrum preparations. The analytical method of Gnadinger and Corl [*R.A.E.*, A, xix, 248] for the determination of the pyrethrin content in a small amount of ground pyrethrum flowers is described in detail.

The second paper is an account of investigations to compare the properties of different species of *Chrysanthemum* (*Pyrethrum*) by this method. *C. cinerariaefolium* grown in the Crimea and North Caucasus had a pyrethrin content fully equal to that of the best specimens from Japan. The quantities of pyrethrin contained in the leaves, stalks and flowers of this plant from the Crimea in different stages of development are given in a table, which shows that the best time for harvesting is when it is in full blossom. As the pyrethrin content of *C. carneum* and *C. roseum*, which grow wild in the northern Caucasus and other parts of Russia, was considerably lower, intensive cultivation of *C. cinerariaefolium* would be more economically justifiable than gathering the flowers of these wild species. A preliminary analysis of other plants of this genus that occur in the Caucasus has shown that the pyrethrin content of *C. macrophyllum* is almost equal to that of *C. cinerariaefolium*, but those of other species are either equivalent or inferior to that of *C. carneum*.

In the third paper recent literature on the use of pyrethrum as an insecticide is briefly reviewed. In laboratory tests against various insects a dust made from *C. cinerariaefolium* from Yalta, containing 1·6 per cent. pyrethrin, was much more effective than dusts prepared from *C. carneum* and *C. roseum*, both these plants having a greater toxicity when growing wild in Transcaucasia than when cultivated in

the north (near Leningrad and Mogilev). When applied at the rate of 0·1 gm. to a surface of about 28 sq. ins., it destroyed 95 per cent. of the larvae of *Loxostege sticticalis*, L., and all those of *Pieris rapae*, L., and *P. brassicae*, L. In the case of *Barathra brassicae*, L., the percentages killed were 66·7 of the first and second instars, 30·6 of the third, and 12·8 of the fifth.

In spraying tests, an alcoholic extract of *C. cinerariaefolium*, 1 : 10 and 1 : 100, prepared by Austin's method [*R.A.E.*, A, xvii, 677] proved very much more toxic to Lepidopterous larvae than nicotine sulphate at 0·1 and 0·05 per cent. concentrations, and a furfural extract of pyrethrum, 1 : 10, without the addition of soap, was more effective than the alcoholic extract.

[Vuishelesskaya (N. S.).] **Вышелесская (Н. С.). Soap as Insecticide.** [*In Russian.*]—*Bull. Plant Prot.*, iii, no. 1, pp. 175–182. Leningrad, 1931. (With a Summary in English.)

An account is given of laboratory and field investigations on the toxicity to Aphids of various liquid soaps prepared from different kinds of crude fatty substances, and experiments to determine the manner in which a soap solution affects insects. The chemical nature of soap is briefly discussed, and the percentages of the various fatty acids contained in the soaps tested are given. It was found that seal fat soap was the most effective, being followed, in descending order of toxicity, by soaps made from coconut oil, linseed oil, cottonseed oil, oleic acid, whale oil, suet, colophony and castor oil. This shows that soaps containing unsaturated fatty acids or saturated ones with few carbon atoms are more effective than those containing saturated acids (stearin, palmitin and myristin) with a higher carbon atom content. The toxicity of sodium soaps was not inferior to that of potassium ones. The insecticidal action of soap solutions is due to their power of thoroughly wetting the chitin and waxy surface of insects and of spreading ; this spreading power, which enables the soap solutions to penetrate deep into the tracheal system, is due to low surface tension. The two least toxic soaps, made from colophony and castor oil, have a high surface tension ; moreover, castor oil soap is very feebly hydrolysed. The cause of the variation in toxicity of the different types of soap is to be ascribed not only to the structure of the fatty acids, but also to differences in the degree of their hydrolisation, as free fatty acids play an important part in the toxicity of soap solution [*cf. R.A.E.*, A, xv, 650].

[Petrov (A. D.), Isachenko (V. B.) & Goritzkaya (O. V.).] **Петров (А. Д.), Исаченко (В. Б.) и Горицкая (О. В.). The "Contact" as Activator of contact Insecticides.** [*In Russian.*]—*Bull. Plant Prot.*, iii, no. 1, pp. 183–187, 3 graphs, 7 refs. Leningrad, 1931.

In view of the fact that hundreds of tons of nicotine sulphate, with soft soap as a spreader, are used yearly in the Russian Union in sprays against insect pests, an attempt was made to find a product manufactured in the country with an action similar to that of Inman's " activator " [*R.A.E.*, A, xvii, 714], the addition of which to the sprays would permit of a considerable decrease in the concentration of nicotine and of the exclusion of the expensive soft soap.

Of the two preparations tested, one is a product of sulphonation of carbon acids from the Emba solar oil. In Russia, the oxidation of solar oil is effected at temperatures of 90–100°C. Carbon acids, which are one of the chief products of oxidation, were used to prepare the activator; their chemical and physical properties are given. They were distilled at temperatures between 80 and 300°C. in a vacuum of 25–30 mm. The sulphonation was carried out by gradually adding and stirring in 1–1½ parts of sulphuric acid (of specific gravity 1·84) to 5 parts of carbon acids in such a way that the temperature of the mixture did not rise above 30°C. The mixture was then left to stand for 24 hours. The sulpho-acids formed were washed with a saturated solution of common salt and neutralised with a 20 per cent. solution of caustic alkali.

The other preparation tested is obtained during the refinement of mineral lubricating oils by means of fuming sulphuric acid. In the course of this process the dehydrogenisation and sulphonation of the hydrocarbons takes place simultaneously, and sulpho-acids soluble in the oil that is being refined are formed. G. S. Petrov has found that these sulpho-acids may be extracted with about 50 per cent. alcohol; the product obtained, which contains 40 per cent. sulpho-acids and 15 per cent. oil, is sold under the name of "Contact." It is a clear, syrup-like, fluorescent liquid that dissolves in water, producing a lather when shaken, and possesses a high-grade washing power in acid, neutral and alkaline media. The acids of "Contact" are monobasic, with an average molecular weight of 350, and according to an elementary analysis the formula is $C_{20}H_{27}SO_3$; in comparison with Inman's "activator" it contains less oxygen and more sulphur.

When used against Aphids, nicotine sulphate diluted at the rate of 1:4,000 with the addition of 0·5 per cent. "Contact" gave much better results than at 5 times this strength in combination with soap and soft water. Nicotine sulphate at a concentration of 1:4,000 with the addition of 0·5 per cent. of the solar oil activator gave slightly less good results than at a concentration of 1:800 with soap and rain water, but was considerably more effective than at the latter concentration with casein and hard water.

[Petrov (A. D.).] **Петров (А. Д.). The Problem of Selection of Mineral Oils for the Purpose of Control of agricultural Pests.** [*In Russian.*]—*Bull. Plant Prot.*, iii, no. 1, pp. 189–195, 11 refs. Leningrad, 1931. (With a Summary in English.)

The author discusses the composition of tar distillates and points out that, owing to the varying proportions of their components, the differences in the temperatures at which they are distilled and the various types of coke ovens employed, the commercial product cannot be relied upon to give uniform toxicity as an insecticide. A standardised product could, however, be obtained by basing its composition on the neutral components (chiefly aromatic hydrocarbons), the basic ones being removed by the action of sulphuric acid, and the acid ones by means of alkali. A small constant percentage of phenols should then be added to the emulsion.

The commercial production of crude oil and the composition of crude oils from various parts of Russia are also discussed. A high content of aromatic hydrocarbons renders a raw material more toxic to insects, but also more liable to cause scorching of plants. Highly refined oils

consisting of naphthene hydrocarbons only are considerably more expensive and less toxic, and are easily oxidised, the latter property rendering them unfavourable to plants. Thus, the most satisfactory material would be one that, without being highly refined, consisted chiefly of naphthene hydrocarbons with a small quantity of aromatic hydrocarbons.

[Savel'ev (A. I.).] **Савельев (А. И.). On Naphtha Emulsions of the Type of Jellies.** [*In Russian.*]—*Bull. Plant Prot.*, iii, no. 1, pp. 197–199, 3 refs. Leningrad, 1931.

In view of the high cost of concentrated liquid stock oil emulsions, which usually contain over 20 per cent. of the emulsifier, and the unsuitability for the control of insect pests of the emulsions manufactured in Russia, an attempt has been made to produce stable and effective semi-solid stock emulsions, which owing to the lower percentage of emulsifier in them, are considerably cheaper.

Stable " jellies " from various mineral oils were obtained with soft soap or sodium naphthene soap. The preparation consisted in thoroughly mixing water with an equal or larger quantity of the emulsifier and then stirring in the oil. The compositions of the concentrated jellies obtained and of the emulsifiers are shown.

[Nemiritzkiĭ (B. G.).] **Немирицкий (Б. Г.). Naphtha Oils and Polysulphides in the Control of Sucking Insects in Winter.** [*In Russian.*]—*Bull. Plant Prot.*, iii, no. 1, pp. 201–214, 3 refs. Leningrad, 1931. (With a Summary in English.)

The advantages of the use of dormant oil sprays for the control of Coccids and Aphids are briefly discussed, and the characteristics for evaluating American petroleum oils to be used for insect control are indicated from the literature [*R.A.E.*, A, xviii, 302; xvii, 75; xiv, 650]. Experiments were carried out in southern Crimea from the end of January to the end of March 1930 to test the effectiveness of the Russian petroleum oils against various Coccids and *Aphis pomi*, DeG. Boiled stock emulsions were prepared from 7 different fractions of petroleum by the American method [xv, 625], the proportions used being 2 gals. oil and 2 lb. soft soap to 1 gal. water, and miscible oils were made with two of the fractions with carbon soap (potassium salt of carbon acids, the latter being obtained by oxidising petroleum distillates with atmospheric oxygen). The sprays were used in concentrations of actual oil varying from 10 to 25 per cent. in the case of boiled emulsions or rather less in the case of the miscible oils. Solar oil proved the most effective of the substances tested and caused no damage to the plants. All the emulsions and miscible oils in all concentrations were equally effective against the hibernating larvae of *Lecanium* (*Eulecanium*) *corni*, Bch., on plum and *L.* (*Sphaerolecanium*) *prunastri*, Boy., on peach, giving 100 per cent. mortality, and it is believed that a lower concentration, perhaps only 6 per cent., would produce the same results. Oils rendered miscible with carbon soap appeared to be of higher toxicity than the same oils emulsified with soft soap, but were more injurious to the plants. The adults of *Epidiaspis pyri*, Colvée, on pear proved to be more resistant than the second instar larvae of *Aspidiotus ostreaeformis*, Curt., on plums and the eggs of *Lepidosaphes ulmi*, L., on poplar, though 100 per cent.

mortality of them was sometimes obtained. None of the preparations tested proved a sufficiently reliable ovicide for *Aphis pomi* on apple, pear and quince, though single instances of positive results indicate that an effective spray may eventually be produced.

Lime-sulphur solutions did not injure the plants. They were effective against *Lepidosaphes ulmi* and *A. ostreaeformis* but not *Lecanium corni*, and it appears that they kill Coccids covered with a hard scale, which are resistant to oils, but are otherwise inferior to the latter.

[Vuishelesskaya (N. S.) & Zarkhin (M. M.).] **Вышелесская (Н. С.) и Зархин (М. М.). Soaps of Naphthenic Acids and Naphtha Emulsions in the Control of Coccids on the Citrus Plants and Tea Bush.** [*In Russian.*]—*Bull. Plant Prot.*, iii, no. 1, pp. 215–231, 1 ref. Leningrad, 1931. (With a Summary in English.)

A detailed account is given of field and laboratory experiments carried out in the summer of 1930 near Batum with petroleum oil emulsions against *Chrysomphalus aurantii*, Mask., *Coccus* (*Lecanium*) *hesperidum*, L., and *Ceroplastes sinensis*, Del Guerc., on *Citrus*, and *Pulvinaria floccifera*, Westw., on tea. The emulsions were prepared by means of the cold-mixing process described by Savel'ev [*R.A.E.*, A, xx, 201]. A " jelly " emulsion of machine oil with a 40 per cent. content of soft soap proved the most effective and the least expensive, concentrations of 0·5 and 1 per cent. killing 82 per cent. of the larvae of *P. floccifera* and 98 per cent. of those of *C. hesperidum* respectively without scorching the plants, while 4 per cent. gave 92 per cent. mortality of the adult females of *C. aurantii*. Liquid stock emulsions prepared with carbon or naphthene soap (the latter being obtained in the process of neutralising natural naphthene acids of crude oil), and jelly emulsions containing 4·39 or 20 per cent. of soft soap caused severe scorching of *Citrus* and tea in concentrations that gave 100 per cent. mortality of the Coccids.

Sprays of soft soap alone (0·5 per cent.) killed 80 per cent. of the larvae of *C. hesperidum*, and 3 and 6 per cent. concentrations of dolphin oil soap destroyed 98 per cent. of the larvae and adults respectively, no damage being caused to the leaves. As, however, these soaps are expensive, various concentrations of the cheaper naphthene and carbon soaps, and an alkali residue, which is obtained in the process of refining certain petroleum distillates, were tested. The results showed that these products may be successfully substituted for soaps made of vegetable or animal fats. A 12·5 per cent. concentration of alkali residue killed all the mature larvae of *C. aurantii* and 93 per cent. of the adult females. Sprays of naphthene soap (which is more toxic than the carbon soap) or alkali residue are recommended for use on both *Citrus* and tea. On *Citrus* they should be applied in the second half of July against *Coccus hesperidum*, at the end of August or in September against *Ceroplastes sinensis*, and in March against *Chrysomphalus aurantii*.

A mortality of 98 per cent. of the larvae of *C. hesperidum* was obtained with a 6 per cent. concentration of an emulsion containing 66 per cent. kerosene and 20 per cent. soft soap, which did not injure the plants. A decrease in the quantity of emulsifier reduced the effectiveness of the spray, whereas in the case of machine oil the reverse was the case. This is due to the fact that, as has been proved by special tests, the volatile illuminating oils are less toxic than the

lubricating ones. Kerosene emulsion was about twice as expensive as lubricating oil emulsion ; neither affected the flavour of tea.

Spraying *Citrus* with lime-sulphur in concentrations that did not scorch the leaves gave only a low mortality of the larvae of *C. hesperidum*.

[Sinitzkiĭ (N.), Shekera (E.) & Levkovtzeva (V.).] **Синицкий (Н.), Шекера (Е.) и Левковцева (В.). Comparative Tests of the Effect of Sodium Fluoride, Sodium Silicofluoride and Barium Chloride on the Beetroot Weevil** (*Bothynoderes punctiventris*). [*In Russian.*]—*Naukov. Zap. tzukr. Promisl.* [*Sci. Notes Sugar Ind.*], xiii, no. 3, pp. 831–842, 1 graph, 4 figs. Kiev, September 1931. (With a Summary in English).

A detailed account is given of experiments carried out in June 1931 in the environs of Kiev to determine the toxicity of sodium fluoride and sodium fluosilicate to *Bothynoderes punctiventris*, Germ., on sugar-beet, and to compare their effectiveness with that of barium chloride. The tests were conducted in experimental plots, beet plants in various stages of development being artificially infested with adult weevils. The fluorine compounds were used at various concentrations between 0·4 and 1·5 per cent. and barium chloride at 5–6 per cent. The former proved as toxic as the latter, though their action was considerably slower, the maximum mortality being usually reached in 7 days as compared with 4 days in the case of barium chloride. On the other hand, their toxicity was much less affected by damp or rainy weather ; with barium chloride a high rate of mortality was only obtained on hot and sunny days. Moreover, weevils poisoned with barium chloride continued to feed for some time, thus sometimes destroying whole plants. This is explained by their need to satisfy the thirst caused by the poison, and if the leaves are wet, the weevils may survive. In the case of sodium fluoride and sodium fluosilicate they cease feeding 20–60 minutes after poisoning. On an average in all experiments the highest rates of mortality were obtained with these insecticides at a concentration of 0·7 per cent., though in some instances weaker concentrations also gave good results. At concentrations of over 1 per cent. they scorched the beet plants. There was some evidence that the fluoride was rather more toxic than the fluosilicate.

[Pyatnitzkiĭ] Pjatnitzkij (G. K.). **Drei neue Waldschädlingsarten aus Kirgisien.** [Three new Forest Pests from the Kirghiz Republic.]—*Ent. Bl.*, xxvii, no. 4, pp. 167–173, 2 figs. Berlin, 31st December 1931.

The new Scolytids described are *Pityophthorus kirgisicus*, *P. parfentievi*, and *P. schrenkianae*, all of which were obtained from weakened or felled spruces (*Picea schrenkiana*) in the Kirghiz Republic.

de Peyerimhoff (P.). **Description d'un nouveau** *Carphoborus* **(Col. Scolytidae) parasite du Pin d'Alep à la fois en Provence et sur le littoral algérien.**—*Bull. Soc. ent. Fr.*, 1931, no. 19, pp. 274–275. Paris, 1931.

The Scolytid, *Carphoborus attritus*, sp. n., was taken near Algiers and also at Hyères, in each case in small branches of *Pinus halepensis*. The characters differentiating it from *Carphoborus pini*, Eichh., which attacks the same tree on the Algerian coast, are given.

Šámal (J.). **Kůrovcová kalamita našich ovocných stromů.** [The Bark-beetle Outbreak on Fruit Trees.]—*Ochr. Rost.*, xi, no. 3–4, pp. 98–103, 3 figs. Prague, November 1931. (With a Summary in German.)

The unusual outbreak of bark-beetles that occurred on fruit trees in Czechoslovakia in 1930 [*R.A.E.*, A, xix, 325] continued in 1931, when *Scolytus* (*Eccoptogaster*) *mali*, Bech., and *S.* (*E.*) *rugulosus*, Ratz., caused serious damage to plums and apples and to a less extent to pears and cherries. They occurred in such numbers that they were able to attack perfectly healthy trees. Brief notes on their biology and the type of their galleries are given. In several cases completely developed adult beetles were found in the galleries together with hibernating larvae and pupae as early as mid-February, though the beetles do not usually occur before May or early June. In order to avoid the danger of a further spread of infestation and a possible complete destruction of all orchards in Czechoslovakia, it is recommended that all infested trees should be destroyed.

Unidentified mites, probably of the genus *Pediculoides*, were present in numbers on infested trees, preying upon the larvae and pupae of the bark-beetles.

Horník (A.) & Nolč (S.). **Pokusy s hubením larev muchnice dubnové** (*Bibio marci* **L.**) **a poznámky o jejich biologii.** [Experiments in the Control of the Larvae of *B. marci* and Notes on its Biology.]—*Ochr. Rost.*, xi, no. 3–4, pp. 115–120, 1 fig. Prague, November 1931.

A brief account is given of the results of laboratory and field experiments carried out against the larvae of *Bibio marci*, L., which is a common pest in Czechoslovakia and caused particularly severe damage to cereals in 1930 [*R.A.E.*, A, xix, 129]. All the artificial manures tested, besides improving the condition of the plants, had either a repellent or toxic effect on the larvae, the rate of mortality ranging between 16 and 79 per cent., as against a maximum of 8 per cent. in untreated soil. The highest rate was obtained in the case of nitrogenous lime applied at the rate of 1 lb. to 50 sq. ft. with subsequent watering of the soil, the quantity of water used corresponding to a precipitation of 10 mm. In many instances after the application of manure, as many as 38–80 per cent. of the larvae made their way to the soil surface and were thus exposed to poultry and other birds. Both rolling and flooding the soil forced about 80 per cent. of the larvae to the surface, where they subsequently died. The addition of burnt lime to compost manure, in which the larvae readily breed, killed a considerable percentage. Of the insecticides tested, 1 and 2 per cent. sprays of tobacco extract containing 7 per cent. nicotine sulphate, applied at the rate of about 55 gals. to the acre, killed 42 and 52 per cent. of the larvae respectively, as compared with a death rate of 6 per cent. in untreated soil.

Experiments in which various cultivated plants were subjected to attack by the larvae showed that barley and sugar-beet are preferred. It was found that the larvae are decidedly thermotropic ; in the winter they burrow to a depth of about 5 ins., occurring always in places exposed to the sun. If the soil becomes frozen or excessively dry or wet, the larvae congregate together in masses. Outbreaks depend

largely on the mildness of the winter, the larvae not being able to survive severe cold. The serious outbreak of 1930 may be explained by the preceding mild winter, when the soil did not freeze. The ant, *Myrmica rubra*, L., was observed attacking the larvae.

MAGERSTEIN (Č.). **K invasi krytonosce** (*Cryptorrhynchus lapathi* **L.**) **na Moravě.** [On the Outbreak of *C. lapathi* in Moravia.]—*Ochr. Rost.*, xi, no. 3–4, pp. 122–129. Prague, November 1931.

Both the larvae and adults of *Cryptorrhynchus lapathi*, L., cause serious damage to American willow [*Salix americana*] in Moravia, where it is extensively cultivated. The two-year life-cycle of this weevil [*R.A.E.*, A, xv, 10] is described; hibernation occurs in the egg and adult stages. Pupation takes place in the mines made by the larvae in the stems. The adults usually attack healthy willows two years old, but in severely infested plantations they also occur on those 5–6 years old. In the first year of attack, the infestation can only be detected by the presence of frass on the bark from the mines made by the larvae. In the second or third year, however, the leaves lose their bright red colour; the rods become weak and shortened owing to injury to their tips, and fewer are produced; and the wood in the stems is dry and crumbling. Young plants may recover under favourable conditions, but older ones are usually killed.

It is important to effect control before the injury becomes too severe. Special attention should be devoted to the destruction of the eggs, the most effective measure being a tar distillate spray applied at a strength of 5 per cent. in summer and 7½ per cent. in the dormant period. The best time for treatment is early in spring. Spraying should start in the second year after the planting of the willows, while the rods are still strong, and be continued for at least 4–5 consecutive years, as there is always a danger of reinfestation from adjoining plantations. Artificial manures should also be applied to stimulate the development of the stocks. If, however, the infestation is too advanced, these measures are not economically justifiable, and such plantations should be dug out. Recent investigations in Moravia have shown that almost all plantations of *S. americana* are severely infested, especially those of three-year-old willows.

BERTOLINI (F.). **Distribuzione dei Parassiti delle piante forestali in Alto Adige.**—*Atti Acc. sci. ven.-trent.-istr.*, (3) xx, pp. 103–132. Padua, 1929. **Distribuzione degl'Insetti parassiti delle foreste altoatesine in rapporto coll'altitudine.**—*Arch. zool. ital.*, xvi, no. 1–2, pp. 687–689, 1 ref. Turin, 1931.

Lists are given of insect pests of forest trees taken at different altitudes between 2,600 and 7,000 ft. in the Alto Adige.

MALENOTTI (E.). **Note sulla** [Notes on] *Aelia acuminata* **L.**—*L'Italia agricola*, lxviii, no. 12, reprint 22 pp., 23 figs., 15 refs. Piacenza, December 1931.

MALENOTTI (E.). **I coni salivari dei Pentatomidi.** [The Saliva Cones of Pentatomids.]—*Atti Accad. Agric. Sci. Lett. Verona*, (5) ix, pp. 141–148, 5 pls., 15 refs. Verona, 1931.

In 1931, *Aelia acuminata*, L., caused a loss of about 100 tons of the wheat crop in the province of Verona and a depreciation in quality of

much more. The weight of injured grain is greatly reduced, and its germination is also affected. At harvest time the bugs collected on the sheaves, and if crushed in threshing their bodies give an unpleasant odour to the grain. At Verona the hibernated adults caused injury in April and oviposited in May, and the new adults began to appear at the end of June. These were not seen mating, at least not in July or August, nor were they observed to oviposit in 1931. The bugs migrate from fields in which eggs are laid after having destroyed all the grain available, but this may be prevented by means of quite narrow water channels. At harvest time excellent results were obtained with a 3 per cent. solution of sodium arsenite sprayed on the bugs shaken out of the sheaves, and there was a great decrease in the numbers found in fields in which this measure was applied. Turkeys and ducks will destroy large numbers. Bugs left in the fields after the removal of wheat attacked maize, but no appreciable damage was done.

A large portion of the paper is devoted to a description of the cones of saliva at the punctures made by *A. acuminata*. These cones enable its presence to be detected though it may not be evident otherwise. The second paper is an extract of this portion of the first.

Quayle (H. J.). **Mediterranean Fruit Fly Survey in Europe and Africa.**—*E. 283*, multigraph 17 pp. Washington, D.C., U.S. Dept. Agric. Bur. Ent., 28th January 1931. [Recd. February 1932].

In connection with investigations on *Ceratitis capitata*, Wied., in Florida in 1929, the necessity for information on its habits in countries where it has been long established was recognised, and a survey was carried out from August 1929 to June 1930 in Bermuda, the Azores, Africa and the countries bordering the Mediterranean. The results are reported in detail in this paper, which contains an introduction by C. L. Marlatt. Records of *C. capitata* on apricots near Madrid and Paris probably represent the northern limits of its distribution in Spain and France [*R.A.E.*, A, xvii, 285]. It is of importance chiefly in the south of Spain and along the coast of France and Italy, in which latter country it may be a pest in the interior south of Naples; it also occurs in Greece, Syria, Palestine, Egypt, northern Africa and in most of the islands in the Mediterranean and is found generally in the Union of South Africa. Cold winters limit its distribution and less cold ones its destructiveness. Its distribution in Europe indicates that it would be a pest in the south of the United States, possibly as far north as the Ohio river, and on the Pacific coast as far as Oregon and possibly Washington [*cf.* xx, 33].

In countries having a subtropical climate like that of the Mediterranean region and South Africa, peaches are the fruits most severely damaged; nectarines are also very susceptible, and *Citrus* is attacked if it is mature during the active season of the fly. Pears are more susceptible than apples, possibly because they mature earlier. Neither figs nor dates are preferred hosts. Quinces were commonly infested in Pretoria in March. In Malta *C. capitata* has been reared from jujube [*Zizyphus*], which may be a new record. Late apricots seem to be commonly infested. Prickly pear [*Opuntia*] is the most common of the wild hosts growing near cultivated fruits in arid regions, but is only occasionally infested. In the Mediterranean region, at any rate in Spain, and also in South Africa, vegetables are not attacked to any extent. Tomatos, in which the fly readily oviposits in the laboratory, were not found infested anywhere. Under natural conditions the fruit

must reach a certain stage of maturity before it is susceptible to attack ; oranges must show some yellowing, and though peaches are attacked earlier than most of the other fruits, they are not infested while hard and green. The time of attack of early fruits, such as loquats and apricots, under conditions at Valencia depends on the appearance of the fly.

Its seasonal history varies within its range of distribution ; in Egypt and Hawaii it is active throughout the year ; at Valencia it is present from June to January ; and in cooler parts of its range the active season is undoubtedly much shorter. At Valencia egg-laying ceased after the beginning of December, and from observations in the laboratory it was found that though adults may emerge during the winter they die without ovipositing. The author considers that the winter is passed chiefly in the puparium, and that such flies as are present have recently emerged.

The economic importance of the fly is dependent on climatic conditions and also on the sequence of fruits attacked. The growing of peaches is undoubtedly restricted in many areas owing to its depredations. Infestation in oranges in Spain is estimated at about 1 per cent., the damage occurring chiefly in October and November. Oranges maturing late in the summer are seriously infested, and loquats, apricots and pears are also attacked. Several other fruits are occasionally infested.

In the Mediterranean region little is done for the control of *C. capitata* ; but in South Africa the thorough application of control measures enables the highest quality of peaches to be grown in spite of the fly, and fruit for export is carefully selected [*cf.* next paper].

Pettey (F. W.). **The Fruit-fly : Its Influence on Exports.**—*Fmg. S. Afr.*, 1931, reprint no. 57, 4 pp. Pretoria, August 1931.

Parts of the preceding report that have particular reference to South Africa are quoted in view of the investigations on the effect of refrigeration on the control of *Ceratitis capitata*, Wied. [*R.A.E.*, A, xix, 471] with reference to the export of fruit *via* England to the United States. Considering the care taken in South Africa to ensure the freedom from infestation of goods for export, the introduction of the fly into the United States from this source would be most unlikely.

Chabrolin (C.). **Les ennemis des cultures en Tunisie.**—*Expos. colon. int. Paris 1931*, reprint 13 pp. Paris, 1931.

This brief general account of the pests attacking crops in Tunisia deals mainly with the organisation of control measures and summarises the legislation promulgated in connection with the more important pests. Measures against *Phylloxera* include the destruction of all vines in the infested area and in a specified zone round it, followed by treatment of the soil with carbon bisulphide, a second application being made after an interval of 15 days. Invasions of locusts, of which the most common species is *Schistocerca gregaria*, Forsk. (*peregrina*, Ol.), are controlled by means of zinc barriers and poison baits. Other insects that have been from time to time the subject of legislation include *Platyedra* (*Pectinophora*) *gossypiella*, Saund., on cotton ; *Chrysomphalus dictyospermi*, Morg., which was introduced into Tunisia about 15 years ago and is now a serious pest of oranges ; *Icerya purchasi*, Mask., which has been almost entirely controlled by the introduction of the

Coccinellid, *Rodolia* (*Novius*) *cardinalis*, Muls.; *Dacus oleae*, Gmel., and *Phloeotribus scarabaeoides*, Bern. (*oleae*, F.) on olives; and *Anomala vitis*, F., against which a decree was passed in 1894, but which has long since ceased to attract attention.

COTTERELL (G. S.). **The Occurrence of the Migratory Locust** (*Locusta migratoria migratorioides*) **in the Gold Coast and its Dependencies during 1930.**—*Bull. Dept. Agric. Gold Coast*, no. 23, pp. 255–281, 3 pls., 1 fig., 3 maps, 4 refs. Accra [1931].

During January 1930 small flights of *Locusta migratoria migratorioides*, Rch. & Frm., traversed the Northern Territories, Southern Togoland and the Trans-Volta District of the Gold Coast, being the remnants of swarms that invaded the Colony from the French Haute Volta in September and October 1929. Southern Togoland and the Trans-Volta District were again invaded from French Togoland and from the Afram plains in March 1930, by sexually mature swarms. Oviposition took place in various districts, and was scattered over the Accra plains, as well as in the Southern Province of the Northern Territories. The hatching of hoppers coincided with the planting of cereals, which were subsequently attacked. Control measures were carried out, and the surviving individuals flew off in a north-easterly direction.

Early in May the Northern Province of the Northern Territories was invaded from the east. Hoppers were prevalent in these districts in June and seriously threatened the early cereal crops, so that trenching and driving had to be undertaken on a large scale. The major part of the damage was done by ovipositing swarms. During July and August, except for a few scattered hopper bands, the whole of the Colony was free from locusts, but early in September the north-eastern districts of the Northern Province were again invaded from the Haute Volta, oviposition taking place on an extensive scale. Localised damage was done by the invading swarms. Hoppers occurred late in September, during October and part of November. Control measures were again undertaken and consisted of trenching and driving, and the use of poison bait, successful results being obtained with the latter. Hoppers caused relatively little damage, the cereal crops being sufficiently far advanced; feeding was almost entirely confined to grasses. In November further swarms entered the north-eastern districts from the Haute Volta and from French Togoland. These swarms were immature and travelled westwards, the majority re-entering French Territory. A few travelled south towards the Afram plains, whilst others invaded Northern Ashanti. These swarms caused no damage to cereal crops in the Northern Territories, but localised damage was done to maize in Northern Ashanti. Southern Togoland and the Eastern Province of the Colony were again invaded in November by immature swarms from the Afram plains and from French Togoland. Localised damage was done to late maize. As the dry season advanced, swarms split up and circled erratically, and later a number of subsidiary ones invaded the forest country. Coconuts, oil palms and bananas were attacked owing to the absence of normal food. Independent breeding was found to have occurred on a small scale in Keta-Ada District during December, and to a larger extent in the vicinity of the Afram plains.

Of the various methods of control, a poison bait, consisting of 4 oz. sodium arsenite and 25 lb. dried horse dung or chopped grasses,

was found to be the most effective, as total extermination of hoppers can be obtained from it. It cannot, however, be used in all localities.

The bionomics of this locust are briefly discussed. The life-history is variable, being chiefly influenced by temperature. The incubation period ranges from 10 to 15 days, and the larval period from 40 to 60 days. It is suggested that permanent breeding grounds from which the present swarming phase arose are in the vicinity of the River Niger in Senegal, or in the swamp district in the eastern corner of the Haute Volta, just north of Dahomey. To cope with future invasions, it is essential for these breeding grounds to be located and the conditions necessary for the change to the swarming phase to be studied thoroughly.

Husain (M. A.) & Bhalla (Hem Raj). **Some Bird Enemies of the Desert Locust** (*Schistocerca gregaria*, **Forsk.**) **in the Ambala District** (**Punjab**).—*Ind. J. Agric. Sci.*, i, pt. 5, pp. 609–619. Calcutta, October 1931.

An annotated list is given of 35 species of wild birds belonging to 18 families that were found to attack *Schistocerca gregaria*, Forsk. (desert locust) during a serious outbreak in the Punjab in the spring of 1930 [*R.A.E.*, A, xix, 136]. A number of domestic birds, such as fowls, guinea-fowl and swans, were also observed to feed on the locusts.

Beeson (C. F. C.). **The Life-history and Control of** *Celosterna scabrator* **F.** (**Col., Cerambycidae**).—*Ind. For. Rec.*, xvi, pt. ix, pp. 279-294, 2 pls. Calcutta, 1931. Price 10*d*.

Celosterna scabrator var. *spinator*, F., a Lamiid widely distributed in India, is well-known as a pest of *Acacia arabica*, but also attacks several other trees, a list of which is given. Descriptions are given of the immature stages, oviposition, larval tunnel and the effect of larval injury on the plant. Under insectary conditions, emergence began on 25th June 1929 and continued till 6th October. It was found that temperature and relative humidity have little independent effect on the rate of emergence and that rainfall is the most important stimulus. The beetles begin to emerge with the onset of the monsoon, and with abundant rain in July and August 75 per cent. would have appeared by the end of July and 95 per cent. by the end of August. Their numbers decrease rapidly in September, and at the end of October most of them are dead. The beetles, which may fly considerable distances, feed on the bark of the young shoots in irregular patches, so that the shoots may be completely girdled and die back. The injury extends down the whole length of the current year's growth and may also affect older shoots. They have also been recorded as attacking the bark of cotton, apple and rose, but careful observation at Berar in 1930 did not reveal a single instance of any damage done to cotton.

On *Acacia* the eggs are laid in young plants, in stems 2-9 ins. in girth, usually not more than one egg being deposited in each stem, within about six inches from the surface of the ground. The average incubation period was 19 days at Dehra Dun in August 1929. The larva on hatching feeds on the soft tissues around the oviposition cavity and then bores into the stem, working downward towards the root. This Lamiid is the only Longicorn known to bore into living trees of *A. arabica*. The larval period occupies 9–10 months, and the pupal 15–17 days, pupation taking place in a chamber prepared within the tunnel, close to the outer bark. The exit-hole is usually just below ground level.

In glass tubes the larvae were attacked by a wilt disease. With the exception of two larvae from the United Provinces that were parasitised by a Tachinid, no parasites have been obtained from the numerous individuals reared. It is suggested that this Tachinid should be investigated with reference to the possibility of establishing it in areas from which it is absent.

Control measures include grubbing up infested trees and collecting adults by hand, the relative merits of which are discussed. A mixture of paradichlorobenzene and petroleum (6 fl. oz. to 4 gals.) is an efficient insecticide against the larvae. The infested plant should be cut off at ground level with an axe and a small quantity of the mixture poured into the gallery through a funnel, a dipper of 8 cc. capacity being used to measure each dose. Four gallons of oil are sufficient for 1,900 trees. This measure should be carried out from November to February. Silvicultural methods of control are discussed. In heavily infested areas, in order to get immediate protection and reduce injury to a tolerable degree, it is necessary to eliminate the breeding grounds completely and to stop the regeneration of *A. arabica* for at least two years. It is further suggested that its cultivation should be restricted to suitable localities. A modified scheme based on these suggestions has been drawn up for the regeneration of certain forest areas over a period of 3 years.

King (C. B. R.). **Effect of burning Grass Land on the White Grub (*Anomala* sp.) Population.**—*Tea Quarterly, J. Tea Res. Inst. Ceylon*, iv, pt. 3–4, pp. 100–101. Kandy, November 1931.

Counts of larvae of *Anomala* sp., taken in Ceylon from plots of burned and unburned grassland, show that burning had no effect on them

Betrem (J. G.). **Enkele opmerkingen over den takkenboeboek en zijn schade.** [Some Remarks on the Coffee Twig Borer and the Injury done by it.]—*De Bergcultures*, v, p. 1100 (reprint 6 pp.). **Beschrijving van de door het Proefstation gewenschte proeven over den takkenboeboek.** [Description of the Experiments on the Coffee Twig Borer desired by the Malang Experiment Station.]—*T.c.*, p. 1102 (reprint 10 pp.). [? Batavia] 3rd October 1931.

The conclusion reached in the first article is that the black coffee twig borer [*Xyleborus morstatti*, Hag.] may be very injurious in Java, but cannot be regarded as the chief cause of crop loss in a plantation of young bushes. The second describes various control measures that planters are desired to try.

Franssen (C. J. H.). **De biologie van *Rhodoneura myrtaea*.**—*Natuurhist. Maandbl.*, xx, nos. 8, 10, 11, 12, pp. 117–120, 144–148, 158–161, 173–176, 5 figs., 6 pls., 18 refs. Maastricht, August, October, November, December 1931.

In the Netherlands Indies gutta percha is only produced at one locality in Java, where *Palaquium oblongifolium*, *P. bornëense* and *P. treubii* are grown. The gutta percha is obtained from the leaves, which are plucked at regular intervals, and from the twigs removed when pruning. The plants are infested by the leaf-rolling larvae of a Thyridid moth, *Rhodoneura myrtaea*, Dru., the severest injury being done to young leaves put out by plants that have been cut back.

Repeated infestation checks growth or may even kill the plant, and crop-losses of 20 per cent. have been sustained.

A brief description is given of all stages of the moth. The eggs are laid at night on the young leaves, usually 1–5 per leaf. At Buitenzorg (at a lower altitude than the plantation) incubation took about 5 days in January 1929. The newly hatched larva at once enters the folds of as yet unopened leaves, spins the edges together and then feeds on the epidermis. After moulting, it eats through the leaf and migrates to an older one. The injured leaves rot or wither and fall prematurely. At Buitenzorg in January 1929 the larval stage lasted 14–20 days with an active period of 12–17. Pupation occurs just beneath the surface of the ground or in moss or fallen leaves, the pupal stage requiring 9–12 days. Of the moths, 72·9 per cent. in one observation and 59·8 in another were females. The chief seasons of budding *Palaquium* are at the beginning of the dry and wet seasons respectively, and in 1928 they occurred in May and December. The main flights of the moth were observed in June 1928 and January 1929, so that their abundance is connected with the presence of shoots. They are also therefore to some extent associated with pruning.

The eggs of this moth are parasitised by *Trichogramma* (*Trichogrammatoidea*) *nanum*, Zehnt., and *Chelonus* sp., and the larvae by two Braconids, two Bethylids, and a Mermithid, *Hexamermis javanica*, Steiner. *T. nanum* appears to develop in about 10 days, so that three generations occur to one of the host, and up to 5 parasites have been obtained from one host egg. The females outnumber the males. Figures of the five unidentified Hymenopterous parasites are given, as well as of two hyperparasites, with brief notes on each.

Franssen (C. J. H.). **De bestrijding van den palaquiumbladroller.** [The Control of the Leaf-roller of *Palaquium*.]—*De Bergcultures*, v, p. 1455 (reprint 15 pp.), 4 refs. [? Batavia] 26th December 1931.

In experiments on the control of *Rhodoneura myrtaea*, Dru. [see preceding abstract], collection of the larvae when plucking the leaves of *Palaquium*, attempts to trap the moths with lights or attractive odours, and severe pruning involving the destruction of the larvae did not give promising results. Spraying with 1 per cent. lead arsenate, repeated every 15 days, keeps the plants free from infestation. The addition of an adhesive is unnecessary. The introduction of ants into the plantation has been suggested, but is considered inadvisable, as *Palaquium* is liable to suffer considerably from the scale, *Lecanium punctuliferum*, Green, which they foster.

van der Goot (P.). *Laphygma exempta* **Walker, een legerrupsenplaag bij padi en maïs in 1930.** [*L. exempta*, an Army-worm Pest of Rice and Maize in 1930.]—*Korte Meded. Inst. Plziekten*, no. 17, 12 pp., 1 pl. Buitenzorg, 1931. (With a Summary in English.)

In December 1930 severe injury was caused to maize and rice in all parts of Java by *Laphygma exempta*, Wlk., which had not previously been recorded as a pest there. All stages are briefly described. The eggs, which are laid on the lower surface of the leaves in batches of 50–100, hatched in 3–4 days in the laboratory. The larval stage lasted a fortnight on maize one month old and three weeks on older maize.

The larvae feed by day as well as by night, and when they have destroyed the plants on a field, they migrate to a neighbouring one, feeding on any Graminaceae that they may encounter. They pupate in dry places under the roots of weeds or grasses, the pupal stage lasting about a week. The total time of development on young maize averaged 25 days, with a minimum of 21 and a maximum of 31. Mating occurs 2–3 days and oviposition 2–7 days after emergence. In a series of 10 observations females laid from 16 to 274 eggs, with an average of 128.

Corbett (G. H.). **Entomological Notes. Fourth Quarter, 1931.**—*Malayan Agric. J.*, xx, no. 1, pp. 34–35. Kuala Lumpur, January 1932.

Experiments against an unidentified Lepidopterous larva damaging golf-greens in Malaya show that a spray of 1½ lb. lead arsenate to 50 gals. water will give satisfactory control, and does not scorch the grass. An unusual instance of damage to the roots of mature rubber [*Hevea*] by larvae of *Leucopholis* sp. was observed over an area of not more than 80 acres. Not only the rootlets, but also the lateral and tap roots were injured. The larvae are attacked by three species of Scoliid wasps. Although only occasionally found on coconut, the larvae of *Telicota palmarum*, Moore, occurred in considerable numbers on young trees in one estate during October. In addition, *Hidari irava*, Moore, and *Amathusia phidippus*, L., were also found towards the end of December. *Amathusia* appeared to be checked by a Chalcid parasite, as many as 27 individuals of which emerged from one pupa.

Bald (J. G.) & Samuel (G.). **Investigations on "Spotted Wilt" of Tomatoes.—II.**—*Bull. Council Sci. Ind. Res.*, no. 54, 24 pp., 9 figs., 2 diag., 5 refs. Melbourne, 1931.

An account is given of further investigations on spotted wilt of tomatos in Australia [*cf. R.A.E.*, A, xviii, 665], and a method by means of which the virus can be transferred by mechanical inoculation is described. Adults of *Frankliniella insularis*, Frankl., are apparently unable to transmit the disease unless they have fed during their larval stage on an infected plant. The incubation period of the disease in the larva is probably between 5 and 7 days under medium temperature conditions. The disease has been experimentally transmitted, either by mechanical inoculation, or by using *F. insularis*, to thirty species of solanaceous plants as well as aster and *Chrysanthemum*. Iceland poppy (*Papaver nudicaule*), nasturtium (*Tropaeolum*) and *Zinnia* have been found to be naturally infected with the disease, and have also been successfully infected under experimental conditions.

Cottier (W.). **The Transmission of Virus Diseases of the Potato by Insects. Leaf-roll.**—*N.Z. J. Sci. Tech.*, xiii, no. 2, pp. 85–95, 7 figs., 5 refs. Wellington, N.Z., October 1931.

Experiments are described in which the Aphid, *Myzus persicae*, Sulz., was proved to transmit the virus of leaf-roll from diseased to healthy potato plants in New Zealand [*cf. R.A.E.*, A, xviii, 519 ; xix, 459, etc.]. Negative results were obtained with *M. solani*, Kalt. (*pseudosolani*, Theo.), *Macrosiphum gei*, Koch, the Jassid, *Erythroneura zealandica*, Myers, *Thrips tabaci*, Lind., and the Lathridiid, *Melanophthalma gibbosa*, Hbst.

Lopez (A. W.). **Entomology Department.**—*Ann. Rep. Res. Bur. Philipp. Sugar Ass. 1930–31*, pp. 227–273, 4 figs., 4 pls., 1 fldg. chart, 14 refs. [Manila, 1931.]

White grubs caused less damage to sugar-cane on the western coast of Negros during 1930–31 than in the previous year [*R.A.E.*, A, xix, 574], probably owing to adverse climatic conditions and, in the author's opinion [*cf.* xx, 111], to the extensive collecting of the larvae and adults carried out in 1930. During the season that the beetles are on the wing, adults of *Lepidiota pruinosa*, Wied., and *Lachnosterna* (*Holotrichia*) spp. were scarce and those of *Stephanopholis philippinensis*, Brenske, almost absent. *Leucopholis irrorata*, Chevr., was also reported from Panay and Cebu, in the latter case from a heavy clay soil having a pH of 7·89 [*cf.* xix, 529]. In the laboratory, fumigation of the soil with potassium sulphocarbonate gave good results against it, but in the field it was less satisfactory and the cost would be prohibitive for large areas. The grub population in plots treated with dry filter-press mud (turned under with a disk plough at the rate of 16 short tons per acre) was 19·6 per cent. less than in those that were untreated. It is possible that the mud favours soil-inhabiting natural enemies.

Investigations indicated that on emergence from the pupal chambers females of *L. irrorata* contain no eggs. It is possible that they begin to develop as the females make their way to the surface of the soil and that the latter are gravid if emergence is sufficiently delayed. The first large flight was observed to occur in the evening following the first heavy rain. The flights lasted for an average of 21·3 minutes, and light intensity appeared to be the controlling factor. The females were more numerous on cane in the evening than in the morning and a higher percentage was gravid. Experiments with various attractants during May were unsuccessful. The means of determining the sexes of *L. irrorata* by the difference in their antennae is described [xx, 170].

The adults of ten Scoliids attacking white grubs in the Philippines are briefly described ; they include, in addition to those already recorded [xix, 575], *Tiphia segregata*, Cwfd., and *Campsomeris aurulenta*, Smith. The latter has been collected from *Urena lobata* and attacks *L. irrorata* and *Lepidiota pruinosa* in the laboratory. The life-cycle averaged 43·2 days. Two species of Mutillids, *Trogaspidia minor*, Ashm., and *T. browni*, Roh., parasitise the cocoons of the Scoliids in Occidental Negros. They are somewhat widely distributed ; males have been found on *Stachytarpheta jamaicensis* and *Crotalaria saltiana*. *Campsomeris aureicollis*, Lep., has been observed feeding on *Leucas javanica* [xx, 111], which it appears to prefer to *S. jamaicensis*, and on *Wedelia biflora* and *Gliricidia sepium*, but the last-named only flowers at certain times of the year. A more detailed account is given of the exchange of Scoliids between the Philippines and Queensland than one already noticed [xx, 186]. Shipment of the cocoons proved a failure, but live adults were successfully transported in cages. Two Australian species, *C. tasmaniensis*, Sauss., and *C. radula*, F., have been received in the Philippines, and both have attacked *L. irrorata*. Bats were observed to feed on the adults of this beetle, and shelters are to be constructed for them in plantations where it is a serious pest.

The weevil damaging the stalks of cane in the Philippines previously known as *Rhabdocnemis lineaticollis*, Heller, has now been determined as *Trochorrhopalus strangulatus*, Gyll. [*cf.* xvii, 108, 109, 903 note].

The central shoot of young cane is killed by the boring of *Eucosma* (*Olethreutes*) *schistaceana*, Sn., *Chilo* (*Diatraea*) *infuscatellus*, Sn., and *Sesamia inferens*, Wlk., the first-named being the most numerous and widespread. The eggs of *E. schistaceana* and *C. infuscatellus* are parasitised by *Trichogramma nanum*, Zehnt., and those of *Chilo* also by *Phanurus beneficiens*, Zehnt. The top-borer, *Scirpophaga* (*Topeutes*) *intacta*, Sn., is attacked by *Elasmus zehntneri*, Ferrière, *P. beneficiens*, *Stenobracon trifasciatus*, Szep., and *Eripternimorpha dammermani*, Roh. *E. zehntneri*, of which as many as 96 individuals have been found on one host larva, completes its pupal period in 7 days; 88·8 per cent. of the adults reared were females.

Trionymus sacchari, Ckll., was exceptionally abundant [xix, 743]. Recoveries have been made of *Scymnus* (*Pullus*) sp. and possibly of *Anagyrus* sp. liberated for its control. The attempt to establish *Encarsia flavoscutellum*, Zehnt., against *Oregma lanigera*, Zehnt. [xix, 446] was unsuccessful. This Aphid was attacked by the Braconid, *Diaeretus* sp., this apparently being the first record for the Philippines. Two species of *Chrysopa* were collected from infested cane, and the larvae of the Coccinellid, *Cryptogonus orbiculus*, Gyll., were found in association with *O. lanigera*. *Neomaskellia* (*Aleurodes*) *bergi*, Sign., which is the commonest Aleurodid occurring in Negros, only occasionally infests cane leaves but is often present on grass on the edges of the fields. A large colony was found severely attacked by the Aphelinid, *Prospaltella tristis*, Zehnt. Leaf-eating caterpillars occurring on sugar-cane in small numbers were the Satyrid, *Melanitis* (*Cyllo*) *leda*, L., and the Noctuids, *Remigia frugalis*, F., and *Cirphis* (*Leucania*) *loreyi*, Dup.; the last-named was attacked by *Apanteles* sp. The pupal period for 7 individuals of *C. loreyi* averaged 11·4 days. A small amount of damage was caused by *Locusta migratoria migratorioides*, Rch. & Frm., in September 1930.

Lists are given of the insects found in the sugar-cane fields of the Philippines and their natural enemies.

VARGAS (J. B.). **The Campaign against the Coconut Leaf Miner** (*Promecotheca cumingi* **Baly**), **1930–1931.**—*Philipp. J. Agric.*, ii, no. 3, pp. 189–207, 5 pls. Manila, 1931.

This official report submitted to the Secretary of Agriculture and Natural Resources in regard to the administration of the successful campaign against *Promecotheca cumingi*, Baly, in the Philippines [*R.A.E.*, A, xviii, 652; xix, 64, 687] shows that a total of 15,000,000 coconut palms became infested during the course of the outbreak, involving an estimated loss of about £1,400,000, including loss in yield and cost of labour. Even greater potential losses were avoided by the control measures adopted, which proved effectual where adequate co-operation was secured.

ALDABA (V. C.). **Collecting Rice Cut-worms by Raft.**—*Philipp. J. Agric.*, ii, no. 3, pp. 229–231, 1 pl., 1 fig. Manila, 1931.

A raft, $2\frac{1}{2}$ yds. long, consisting of bamboo slats $1\frac{1}{2}$ yds. wide, tied together to leave spaces of about $\frac{1}{8}$ inch between the slats, has been successfully used in the collection of the cutworms, *Prodenia litura*, F., and *Spodoptera mauritia*, Boisd., on rice seedlings in the Philippines. The water is turned into the rice seed beds and the seedlings are almost

submerged to force the larvae to the ends of the leaves. A little straw is placed over the surface of the raft, which is then floated and dragged over the seedlings. It presses the leaves under the water, and the larvae crawl from them between the slats and shelter in the straw. When sufficient larvae have been collected, the raft is rolled up and removed, and the larvae destroyed.

MARLATT (C. L.). **Report** [1930–31] **of the Chief of the Bureau of Entomology.**—87 pp. Washington, D.C., U.S. Dept. Agric., 1931. [Recd. February 1932.]

This review of the work of the United States Bureau of Entomology for 1930–31 includes detailed reports of the investigations of the various Divisions.

Parasites of the oriental fruit moth [*Cydia molesta*, Busck] recently imported from southern Europe include *Pristomerus vulnerator*, Panz., which was liberated in the spring of 1931, *Apanteles xanthostigmus* var. *anarsiae*, Fre. & Al., *Zenillia roseanae*, B. & B., and *Ascogaster quadridentatus*, Wesm., which is considered by some authors to be identical with *A. carpocapsae*, Vier. *A. quadridentatus*, however, appears to attack *C. molesta* more freely in Europe than does *A. carpocapsae* in the United States. Six colonies of *Glypta rufiscutellaris*, Cress., have been liberated in peach orchards in Georgia and the Carolinas, and experimental liberations of *Pristomerus ocellatus*, Cush., a fruit-moth parasite found in New Jersey, have been made in Georgia, Tennessee and Indiana. Consignments of *Copidosoma pyralidis*, Ashm., have been shipped by sea and air from southern France to California in 12 days for use against *Anarsia lineatella*, Zell. (peach twig borer), of which it is an important European parasite. Shipments of *Macrocentrus ancylivora*, Roh., have been made from the United States to France to aid in the control of *C. molesta* in that country.

A remarkable reduction in infestation of peach by the plum curculio [*Conotrachelus nenuphar*, Hbst.] since the severe infestation in the southern States in 1929 is attributed partly to late emergence of adults from hibernation in 1930, and to hot, dry weather in early summer, which proved very unfavourable to the pupae in the ground, and partly to thorough control measures. For the most part these conditions were duplicated in the early season of 1931. The most promising of a number of soil treatments tested for the control of the larvae and pupae was spraying the soil with 4 per cent. emulsion of mineral oil in which paradichlorobenzene had been dissolved.

Shipments of *Ascogaster carpocapsae*, which is one of the most important parasites of the codling moth [*Cydia pomonella*, L.], but was found to be absent from the apple growing sections west of the Mississippi, have been made to centres in Kansas and Arkansas. Observations on *Prionus imbricornis*, L., which has become increasingly destructive to apple in north-western Arkansas, have revealed marked differences from the published accounts of the biology of this root borer.

Experiments in Georgia indicated that pecans may be protected from attack by weevils [*Curculio caryae*, Horn] by spraying with hydrated lime. Throughout the period of their activity, the weevils are readily jarred from infested trees by strokes that are not heavy enough to dislodge sound nuts. Experimental spraying in Louisiana has shown that even 6 per cent. oil emulsion does not give complete

control of *Chrysomphalus obscurus*, Comst. Pecan trees appear to be less susceptible to oil injury as the close of the dormant period approaches. Other insects attacking pecan include *Phylloxera devastatrix*, Perg., which has caused serious injury in southern Louisiana, and *Acrobasis cunulae*, Dyar & Heinr., which has recently been found in abundance in southern Georgia. In experiments in Maryland two applications of a heavy lime spray with a little fish-oil soap as an adhesive appeared to reduce infestation of chestnuts by *Curculio proboscideus*, F., and *C. auriger*, Casey, from 44 to less than 2 per cent. Dusting with lime or talc also gave good results.

The distribution and density of infestation by the Japanese beetle [*Popillia japonica*, Newm.] is discussed. Observations indicate that a soil temperature of 50° F. is the threshold of larval activity, as there is a distinct correlation between this temperature and the periodical vertical movements of the larvae in the soil. Moreover the eggs do not hatch at 50° F. or below. These studies suggest that eggs will not survive the winter temperatures experienced even in southern New Jersey. Cold and dryness are the two factors inhibiting the spread of the beetle. The larvae are unable to stand any prolonged low temperatures below 10°F. Prolonged drought or unusually dry conditions at the time of oviposition and shortly afterwards are similarly inimical to the beetle.

Treatment of turf with acid lead arsenate continues to be the best method of controlling the larvae, and investigations show that it is most effective when applied early in summer before the eggs hatch. In studies on its parasites, *Prosena siberita*, F., did not attack *Anomala orientalis*, Waterh., but parasitised 14 per cent. of *Aserica castanea*, Arr. On the latter host it completed a generation in 47 days, although under ordinary conditions it has only one generation a year. *Tiphia vernalis*, Roh., has now been recovered in 6 of the 12 localities in which the original liberations were made [*cf. R.A.E.*, A, xvii, 176, etc.]. In one locality, 10 per cent. of the larvae of *P. japonica* were parasitised by it. During 1930 seven new centres were started. Recoveries were made from only 24 out of the 50 localities where *T. popilliavora*, Roh., was originally liberated [*loc. cit.*], and the numbers present varied considerably. The drought of 1929 was detrimental to both host and parasite. Parasitised larvae of *A. castanea* were found 10 days after the liberation in May 1930 of *Tiphia asericae*, Allen & Jaynes, about 1,500 individuals of which were imported and liberated at different dates in Pennsylvania and Long Island. No adult parasites were recovered, however, in May and June 1931.

Owing to the reduced numbers of *Anastatus semiflavidus*, Gahan, the specific native egg parasite that usually keeps it in check, a serious outbreak of the range caterpillar [*Hemileuca oliviae*, Ckll.] occurred in New Mexico in 1930, causing the destruction of grass on much of the finest cattle ranges in the areas affected. Efforts to breed this parasite artificially were successful, and about 2,000,000 were liberated in May 1931. A successful attempt was made to breed *Paradexodes epilachnae*, Ald., a Tachinid parasite of *Epilachna corrupta*, Muls., introduced from Mexico into Ohio, in a greenhouse throughout the winter. Large numbers were bred from this stock and liberated. Repeated trials have shown that common beneficial Coccinellids are not attacked by this Tachinid.

Experiments have shown that carbon bisulphide placed in 1 oz. dosages 4 ins. deep and 24 ins. apart will penetrate the soil and kill

wireworms to a depth of 18 ins., particularly in sandy-loam soils where the moisture content is 10–20 per cent. Tests with a large number of attractants showed that caproic acid and butyric acid were attractive to the adult males of *Pheletes* (*Limonius*) *canus*, Lec. With abundant food throughout the year, *P.* (*L.*) *californicus*, Mann., may complete its development in two years under optimum conditions, whereas under field conditions 3 years or more are required. *Heteroderes laurenti*, Guér., is becoming of increasing importance to the vegetable industry of the south, where the early potato crop is particularly susceptible to injury. Field studies of the spotted cucumber beetle [*Diabrotica duodecimpunctata*, F.] indicate that it breeds scantily in the south during the summer and that the large winter population consists chiefly of beetles that emerge in the north during the autumn and migrate southward, feeding on flowering plants by the way. Migration into Louisiana is completed about 15th December. The beetles breed throughout the winter, and with the approach of spring begin to move northward. This theory is confirmed by the failure of attempts to carry the beetle through the winter in cages in Iowa and Minnesota. Broad beans, which are very attractive to it, might serve as a trap crop on which the migrating forms could be killed.

Evaporation records taken with atmometer cups in Oregon and Washington indicate that *Forficula auricularia*, L., is normally able to survive only in sections where the evaporation is usually below 200 cc. a week. Potassium silicofluoride was found to be the most effective of 54 poisons tested against it in a bait of bran and fish-oil.

Scapteriscus vicinus, Scudd. (Porto Rico mole cricket) and *S. acletus*, Rehn & Hebard, are becoming important pests on the eastern coastal plain and in the region of the Gulf of Mexico by damaging vegetable seedlings in the field and in seed beds. The crickets may be present at any season, but are most numerous from February till the end of June, when mating and oviposition take place. There is only one brood annually. Studies of the parasites of the beet leafhopper [*Eutettix tenella*, Baker] have afforded further knowledge concerning the limiting factors on the effectiveness of *Aphelinoidea plutella*, Gir., and also the influence on the distribution of the latter of the presence of Russian thistle (*Salsola pestifer*) on which it mainly overwinters.

In experiments in Texas, where the average feeding period of *Platyedra gossypiella*, Saund., within cotton bolls was 12·8–15 days, in no case did the larvae enter the overwintering stage when the temperature averaged 77°F. or above. Below this, 17–68 per cent. entered the long-cycle hibernation stage. Striking proof was obtained of the efficiency of calcium arsenate dust in the control of the bollworm [*Heliothis obsoleta*, F.] on experimental plots of cotton, which received 10 applications at intervals of 5 days, and of the importance of beginning dusting while the larvae of the first generation are small.

In preliminary experiments with the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] in Hawaii, the resistance of the larvae to high temperature varied considerably in different host-fruits, a considerably longer period being required to secure 100 per cent. mortality with kamani nuts than with *Citrus* or other fruits, 7 hours exposure being necessary at 116°F. Between 117 and 123°F. almost uniform 100 per cent. mortality was evident in 1 hour ; at 109°F. 24 hours was required and at 107°F. 40 hours. With loquats 100 per cent. mortality was obtained in 7 hours at 109°F. The range of mortality of the adult flies for exposures of 20–80 minutes was 32–88 per cent. at 108°F.,

flies of different origins or having had access to different quantities of food differing in their resistance to heat. Tests with the pupae at 110°F., involving 11 different time periods, gave a uniform curve beginning with the 15 minute interval up to 85 minutes, after which 100 per cent. mortality appeared in all the experiments.

The Eulophid parasite, *Eretmocerus serius*, Silv., which was introduced for the control of the blackfly [*Aleurocanthus woglumi*, Ashby] in Cuba [*R.A.E.*, A, xix, 570], has multiplied to such an extent that it has been possible to make liberations throughout that Island and also to establish colonies in the Canal Zone and in Hawaii.

Parasites imported from central Europe included *Phorocera agilis*, R.-D., and *Tachina larvarum*, L., which attack the gipsy moth [*Porthetria dispar*, L.] and *Carcelia gnava*, Mg., which attacks the satin moth [*Stilpnotia salicis*, L.]. *Meteorus* sp., which was imported for the control of the latter, has established itself, and another recently introduced parasite of this moth, *Apanteles solitarius*, Ratz., has spread considerably. Small shipments of Hymenopterous parasites of the birch leaf-mining sawfly, *Phyllotoma nemorata*, Fall., which now occurs in Maine, New Hampshire and Massachusetts, have been imported from Austria. Over 80,000 adults of *Chaetexorista javana*, Br. & Berg., which issued from cocoons of *Cnidocampa flavescens*, Wlk., received from Japan were released in the neighbourhood of Boston in 1929 and 1930, and there are indications that this Tachinid has established itself. A colony of *Calosoma sycophanta*, L., collected in Massachusetts, was liberated in Washington in the hope that it will become established there as an enemy of *S. salicis* and *Hemerocampa pseudotsugata*, McD., and puparia of *Compsilura concinnata*, Mg., were sent to Washington and Canada for liberation against *S. salicis*. About 300,000 adults of *Anastatus disparis*, Ruschka, the egg parasite of *P. dispar*, were colonised in Maine.

The mite, *Acarophenax tribolii*, Newst. & Duvall, which attacks flour beetles but has not previously been recorded from North America, was found during the year in various States. The only previously recorded hosts were the Tenebrionids, *Tribolium confusum*, Duv., and *T. castaneum* Hbst. (*ferrugineum*, F.). Other hosts found infested are *Gnathocerus cornutus*, F., *Palorus ratzeburgi*, Wissm., and *Latheticus oryzae*, Waterh. The young female mites live at first upon the adult beetle, later migrating to an egg. They then become greatly distended and die, the young soon afterwards emerging from the parent's body as adults.

Pyenson (L.) & Sweetman (H. L.). **The Effects of Temperature and Moisture on the Eggs of** *Epilachna corrupta* **Mulsant (Coccinellidae, Coleoptera).**—*Bull. Brooklyn Ent. Soc.*, xxvi, no. 5, pp. 221–226, 3 refs. Brooklyn, N.Y., 30th January 1932.

A more detailed study than those previously recorded [*R.A.E.*, A, xviii, 492 ; xix, 208] has been made in Massachusetts on the eggs of *Epilachna corrupta*, Muls. (Mexican bean beetle) with a view to determining the effects of temperature and moisture throughout the ranges for these factors. The technique used in the experiments is described. The following is taken from the authors' summary and conclusions : A temperature of 7°C. [44·6°F.] was entirely unsuitable for embryonic or young larval development. At 12°C. [53·6°F.] no eggs hatched under any conditions of moisture, all embryos dying within 3 weeks. At 15°C. [59°F.] a few eggs hatched in a wet environment, the incubation

period requiring 23 days. Exposure to temperatures varying from 13·5 to 15°C. [56·1 to 59°F.] gave about the same results as 15°C. continuously. At 17°C. [62·6°F.] good hatching was obtained with 74 and 94 per cent. moisture, but very little with 37 per cent. and none with 26. The incubation period was 10 to 11 days. The optimum environment proved to be 22°C. [71·6°F.] temperature with 75 per cent. relative humidity; at this temperature hatching occurred in all humidities from 20 per cent. or above. The incubation period was from 6·5 to 8 days. A temperature of 27°C. [80·6°F.] was favourable with high humidities (76 to 81 per cent.) and unfavourable with low ones. The incubation period was 5 to 6 days. A temperature of 30°C. [86°F.] was unfavourable, only about one-fourth of the eggs hatching with 76 per cent. humidity and none with 20 and 100 per cent. The incubation period was 5 to 5½ days. A constant temperature of 32°C. [89·6°F.] was very unfavourable in all conditions of humidity; when alternated with 22°C., with high and low humidities, the results were intermediate between those obtained at 32 and 22°. Humidities below about 55 per cent. were very unfavourable at all temperatures; high humidities of 95 to 100 per cent. were unfavourable except near the optimum temperature.

Harman (S. W.). **Control of hibernating Caterpillars of the Eye-spotted Budmoth in Apple Orchards.**—*Bull. New York Agric. Expt. Sta.*, no. 600, 18 pp., 5 figs. Geneva, N.Y., November 1931.

The following is taken almost entirely from the author's summary: The hibernating caterpillars of *Eucosma* (*Spilonota*) *ocellana*, Schiff. (eye-spotted budmoth), which sometimes causes severe damage to apples in New York State [*cf. R.A.E.*, A, xvii, 270], usually leave their hibernacula on the twigs and smaller branches just as the first green tips appear on the apple buds and continue emerging until pink shows in the blossoms. Average daily temperatures approaching or exceeding 60°F. stimulate activity. Lead arsenate in the sprays applied when the caterpillars are emerging had very little effect on them, probably owing to their habit of feeding within the buds or webbed leaf and blossom clusters. Various oil sprays, at 6 or 8 per cent. strength, applied before the larvae left their winter shelters also gave poor results, but a combination of an oil spray with nicotine sulphate appeared to be promising. Nicotine sulphate in lime-sulphur caused almost as marked a reduction in the number of larvae. One quart to 100 gals. of spray mixture was more effective than one pint, and is recommended in cases of severe infestation. In normal seasons, the delayed dormant spray of nicotine sulphate generally applied against the rosy aphis [*Anuraphis roseus*, Baker] may prove valuable in reducing injury by *E. ocellana*, provided that the caterpillars have not already left their winter shelters. Where infestation is heavy, it is essential to follow a spray programme that includes a nicotine sulphate spray in the green-tip stage, to be used solely against *E. ocellana*, and a delayed dormant spray containing nicotine sulphate, the primary purpose of which is to combat *A. roseus*. A spray programme giving formulae for these applications is appended.

Entomology and Parasitology.—*Rep. California Agric. Expt. Sta. 1929–30*, pp. 63–69. Berkeley, Cal., 1931.

Tests to determine the value of bait traps in timing sprays against the codling moth [*Cydia pomomella*, L.] show that in orchards where

4 applications, timed by catches of the moths, were given, less than 6 per cent. of the apples were infested, as compared with 35–75 per cent. in orchards where 5–7 applications were made in the usual manner. Cross-inoculation experiments on yellows disease of plants transmitted by *Cicadula sexnotata*, Fall., proved that the viruses of carrot, parsley, celery and aster yellows are identical. In tests with a number of insecticides against *Tetranychus pacificus*, McGregor, on grapes, the most satisfactory results were obtained with a very finely ground sulphur dust. It should be thoroughly applied to both surfaces of the leaves, as soon as the mites begin to appear. Observations on *Hyalopterus arundinis*, F., on plum, show that the stem-mothers may produce as many as 138 young, with an average of 5·5 a day. The succeeding generations on plum reproduce at approximately the same rate. The first winged migrants appeared in the third generation and continued to do so up to the ninth. Winged sexuparae returning to plum in the autumn produced on an average 5 young each with a maximum of 8. These develop into sexual females, which, after mating, lay 1–3 eggs. A number of oil sprays were tested against the stem-mothers in early spring and the migrants and sexual females in late autumn, the best results being obtained with a 2 per cent. highly refined oil applied on 16th and 27th March and again on 4th April. The life-cycle of *Hercothrips* (*Heliothrips*) *fasciatus*, Perg., on pears was observed to last 29 days in July. It passes the winter in the adult stage on weeds. The best results against this thrips were obtained with a 2 per cent. light oil spray containing nicotine sulphate, 1 : 1600, or a fine sulphur dust, applied at the rate of 15–20 lb. to the acre. Considerable damage to trees and fruit resulted from heavy applications of sulphur.

Further experiments against *Heliothis obsoleta*, F. [*cf. R.A.E.*, A, xvii, 724] on sweet maize showed that sodium fluosilicate (70 per cent. active and 30 per cent. inert) gave by far the best results among a number of dusts tested. Sodium fluosilicate, black pepper and lead arsenate (1 part to 4 of hydrated lime) produced the best effects when applied to the ear in the silk stage.

CHAMBERLIN (W. J.). **A defoliating Noctuid.**—*Pan-Pacific Ent.*, viii, no. 2, p. 60. San Francisco, Cal., 1932.

In one locality in Oregon large areas of ash (*Fraxinus oregona*) were almost completely defoliated by *Homoncocnemis* (*Homohadena*) *fortis*, Grote, early in May 1931. The caterpillars of the second brood were abundant the second week of July. Pupation occurs in the soil There appears to be no record of this Noctuid in the economic literature.

KEIFER (H. H.). **California Microlepidoptera V (Gelechiidae).**—*Pan-Pacific Ent.*, viii, no. 2, pp. 61–73, 1 fig. San Francisco, Cal., 1932.

Six new Gelechiids are described from California, including *Exoteleia burkei*, the larvae of which bore longitudinal galleries in the developing buds of *Pinus radiata* (Monterey pine) early in the spring, causing rather noticeable damage which is, however, not apparently serious, and *Gelechia demissae*, the larvae of which web together the terminal leaves of young shoots of *Prunus virginiana* var. *demissa* (choke cherry) in April and May. The larvae would not feed on the leaves of cultivated plum though they accepted those of *Prunus ilicifolia*. It is not known whether they will attack cultivated cherry.

Chamberlin (W. J.). **A Weevil new to Oregon.**—*Pan-Pacific Ent.*, viii, no. 2, p. 90. San Francisco, Cal., 1932.

Cryptorrhynchus lapathi, L., which attacks willow, poplar, birch and alder and is readily distributed in infested nursery stock, was reared from damaged willows in Oregon in June 1931. It has not previously been recorded in the United States from further west than Nebraska.

Robinson (R. H.) & Whitaker (C. F.). **Commercial economic Poisons commonly known as Fungicides and Insecticides.**—*Circ. Oregon Agric. Expt. Sta.*, no. 106, 22 pp. Corvallis, Ore., July 1931. [Recd. February 1932.]

This publication reports the results of chemical analyses of various spray materials made in carrying out the provisions of the Oregon economic poison law. In order to obtain a better understanding of the requirements of each spray material, the active ingredients are discussed briefly and desirable standards are indicated.

Diehl (H. C.), Lutz (J. M.) & Ryall (A. L.). **Removing Spray Residue from Apples and Pears.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 1687, 31 pp., 8 figs., 1 ref. Washington, D.C., October 1931. [Recd. February 1932.]

This is a detailed account of methods for removing arsenical spray residue on apples and pears, based on results of experiments conducted in the United States over a number of years. The cleaning of the fruit by means of wiping and brushing, which are not generally satisfactory, and by washing it in cold or warm hydrochloric acid solutions and alkaline solvents, is discussed. Methods for rinsing and drying the fruit and the types of washing equipment are described, followed by a discussion on the cost of removing the spray residue.

Although the method of washing in alkaline solutions is effective, experience has indicated that hydrochloric acid is more easily used and more economical, and is generally preferable in the case of fruit with no particular residue difficulties.

Vance (A. M.) & Parker (H. L.). *Laelius anthrenivorus* **Trani, an interesting Bethylid Parasite of** *Anthrenus verbasci* **L. in France.**—*Proc. Ent. Soc. Wash.*, xxxiv, no. 1, pp. 1–7, 1 pl. Washington, D.C., January 1932.

Cocoons of *Laelius anthrenivorus*, Trani, an ectoparasite of the larvae of certain Dermestids infesting museum collections, were found at Hyères in January 1930 among dry insect specimens infested with *Anthrenus verbasci*, L. This is apparently the first record of this Bethylid in France or as attacking *A. verbasci*. The stages are described, the original description of the adult being translated. The habits of the adults and the act of oviposition are discussed. The adults appear to be negatively phototropic. Having first paralysed the host, the female bites off a patch of its hairs prior to oviposition. Two females were observed to lay 26 and 23 eggs, 3 being the maximum found on a single larva. Two parasites may develop from one host. The larvae hatch within 24–48 hours and consume the entire body contents, leaving only the skin. At about 75°F. the larval period of 10 individuals averaged 9 days. The pupal period was not determined but is known to be rather long.

Dozier (H. L.). **An important new Encyrtid Parasite of the Mealybug,** *Pseudococcus virgatus* **(Ckll.).**—*Proc. Ent. Soc. Wash.*, xxxiv, no. 1, pp. 7–9, 1 fig. Washington, D.C., January 1932.

Anagyrus coccidivorus, sp. n., is described from *Ferrisiana* (*Pseudococcus*) *virgata*, Ckll., on papaya fruit in Haiti, where it is probably the most important factor in its control. This Coccid has been recorded from various food-plants and is widely distributed in the West Indies and the southern United States ; at times it becomes of economic importance in Haiti, completely covering papaya fruits.

Drake (C. J.) & Decker (G. C.). **A Scavenger Fly,** *Chrysomyza demandata* **Fabr., breeding in Corn Silage (Dipt. Ortalidae).**—*Ent. News*, xliii, no. 2, pp. 29–30, 1 pl. Philadelphia, Pa., February 1932.

Chrysomyza demandata, F., which is a scavenger breeding in decaying plant material, was found in Iowa in April 1931 in large numbers in maize silage in which numerous pockets of loose dry fodder were present that were not undergoing the normal heating and fermenting process. These pockets contained decaying and rotten silage in which the maggots occurred. Cattle relished the infested silage and consumed large numbers of maggots during April without any apparent injury.

Watson (J. R.). **Florida Truck and Garden Insects.**—*Bull. Florida Agric. Expt. Sta.*, no. 232, 112 pp., 59 figs. Gainesville, Fla., June 1931. [Recd. February 1932.]

This bulletin, which deals almost exclusively with vegetable pests, is an enlarged edition of one already noticed [*R.A.E.*, A, vii, 418]. It includes notes on various additional insects and on some of the more recently developed insecticides.

Wilson (J. W.). **The Two-spotted Mite** (*Tetranychus telarius* **L.) on** *Asparagus plumosus*.—*Bull. Florida Agric. Expt. Sta.*, no. 234, 20 pp., 6 figs., 9 refs. Gainesville, Fla., June 1931. [Recd. February 1932.]

An account is given of the bionomics and control of *Tetranychus telarius*, L., on *Asparagus plumosus* in Florida, and all stages are described. The mites feed beneath the bracts on the tender shoots, which are dwarfed, and, when very numerous, cause the plants to become brown. They are most abundant during the warm, dry spring months, usually April, May and part of June ; heavy rains hold them in check from the latter part of June until the following spring. The eggs are deposited singly, usually beneath the bracts of the young shoots, one female laying 70 on an average, at the rate of 3–7 a day. Unfertilised eggs produce males only. Breeding occurs throughout the year, the average time required for the completion of a generation being 14·64 days. The removal of all weeds in and around the ferneries is the first step in control, as the mites congregate on the lower surface of the leaves and they act as sources of reinfestation of the ferns after the latter have been sprayed. Two applications, at an interval of 7 days, of a white oil emulsion, 1 : 100, which was the cheapest and safest of the insecticides tested but does not kill the eggs, will give complete control if the plants are thoroughly wetted.

Grossman (E. F.) & Calhoun (P. W.). **Determination of the Winter Survival of the Cotton Boll Weevil by Field Counts.**—*Bull. Florida Agric. Expt. Sta.*, no. 233, 47 pp., 18 figs., 14 refs. Gainesville, Fla., June 1931. [Recd. February 1932.]

The following is taken from the authors' summary : During several years' observations in Florida, data obtained from hibernation cages on the winter survival of *Anthonomus grandis*, Boh., and on its period of emergence were very inconsistent [*cf. R.A.E.*, A, xx, 179], and failed to show a seasonal uniformity of emergence under the same weather conditions as occurred in field tests. Data from field counts were uniform, each year's results corresponding with those of the previous or following years. Field counts conducted in 5 different localities in the State also gave uniform results. The time of appearance of the weevils rarely extended over a period of 30 days, whereas that in hibernation cages lasted over a period of 5 months. The peak of emergence in the field extended from 3rd to 20th June, whereas in the cages it occurred from 5th March to 2nd June. The appearance of the weevils in the field appears to be dependent on temperature conditions during May and June, regardless of the conditions prior to that time. Field counts indicate the percentage of survival and degree of infestation that can be expected from year to year, and from these observations it appears that the weevils enter cotton fields in infested areas during June.

Grossman (E. F.). **Hibernation of the Cotton Boll Weevil under controlled Temperature and Humidity.**—*Bull. Florida Agric. Expt. Sta.*, no. 240, 19 pp., 4 charts, 5 refs. Gainesville, Fla., October 1931. [Recd. February 1932.]

The correlation of temperature and humidity with the emergence from hibernation of *Anthonomus grandis*, Boh., being difficult to determine from field or hibernation cage data [see preceding paper], a study was undertaken in which uniform temperatures and relative humidity were maintained in artificial hibernation quarters in which boll-weevils were placed. The technique employed in the experiments is described. A study of the longevity of the weevils as shown in the tables, combined with hibernation cage data, indicates the possibility of a prolonged period during which the hibernated boll-weevil can enter and infest a cotton field. About 125,000 weevils were used in the experiments, in temperatures maintained at 47°F., 60°F., and 81°F., with a relative humidity between 79 and 85 per cent. After 170 days, 20 per cent. of 32,000 weevils were living ; after 206 days, 15 per cent., and after 236 days, 10 per cent. Approximately 0·6 per cent. lived 300 days, indicating that when hibernation conditions are favourable, one weevil out of each 200 to enter hibernation on 1st October could live long enough to emerge from hibernation on 1st August of the following year, or, entering on 1st November, could emerge on 1st September, though as a matter of fact the majority invaded the cotton fields during June. At 47°F., increased mortality was observed during the first month of dormancy and again after a period of several months of a low rate of mortality. The destruction of cotton stalks immediately after harvest not only reduces breeding but also prevents the weevils already in the field from feeding enough to withstand an extended period of hibernation.

GROSSMAN (E. F.). **Heat Treatment for controlling Insect Pests of stored Corn.**—*Bull. Florida Agric. Expt. Sta.*, no. 239, 24 pp., 11 figs. Gainesville, Fla., September 1931. [Recd. February 1932.]

An account is given of experiments to determine the resistance to heat of insects infesting stored maize in Florida. At 49°C. (120·2°F.), eggs and adults of *Tribolium castaneum*, Hbst. (*ferrugineum*, F.) were killed after an exposure of 30 minutes, and the larvae after 45 minutes ; three hours were necessary to kill the pupae, though those treated for one hour or more failed to develop into vigorous adults. Younger adults resisted higher temperatures than older ones. Adults of *Calandra* (*Sitophilus*) *oryzae*, L., were killed in 10 minutes at 50°C. (122°F.), and in 24 hours at 42°C. (107·6°F.), and those of *Silvanus gemellatus*, Duv., in 10 minutes at 47°C. (116·6°F.), and in 9 hours at 42°C. Adults of *Sitotroga cerealella*, Ol., were killed in 30 minutes at 49°C., and larvae and pupae in one hour at 50°C. An exposure of 30 minutes at 48°C. (118·4°F.) killed all adults of *Gnathocerus maxillosus*, F. In general the experiments indicate that a temperature of 42°C. maintained for about 200 hours, or 50°C. for one hour, would kill all stages of these insects infesting maize.

Exposure of maize seed for 144 hours at 47°C. did not affect the germination or the vigour of the growing plants. An exposure for 5 hours to 59°C. (138·2°F.) appeared to affect the seeds little if at all, as vigorous plants grew from them. Seeds were killed, however, when exposed to 70°C. (158°F.) for 1 hour or 80°C. (176°F.) for 10 minutes. Husked maize, when spread to a depth of 3 ft. on flooring in a tobacco barn, can be effectively treated with an 18-hour exposure, and with a 13-hour one when spread to a depth of $2\frac{1}{2}$ ft., if the air is maintained at a minimum temperature of 83°C. (181·4°F.). When the outside air temperature falls below 10°C. (50°F.), longer exposures are necessary. Seed maize should not be treated together with maize to be used for fodder, since the higher temperatures reached injure germination and plant vigour.

Summary for 1931.—*Insect Pest Surv. Bull.*, xi, no. 10, pp. 651–679, 7 maps, multigraph. Washington, D.C., U.S. Dept. Agric., Bur. Ent., 1931.

This is a summary of records of noxious insects throughout the United States. The distribution of the following is indicated by maps : grasshoppers, the most important species involved being *Melanoplus bivittatus*, Say, *M. differentialis*, Thos., *M. mexicanus*, Sauss., *M. femur-rubrum*, DeG., and *Camnula pellucida*, Scudd. ; *Blissus leucopterus*, Say, which caused injury to maize, oats and various grasses ; *Phthorimaea* (*Gnorimoschema*) *operculella*, Zell., which attacked potatoes and tobacco ; *Listroderes obliquus*, Gyll., which caused serious injury to turnips, cabbages and tomatos ; *Diaphania nitidalis*, Stoll, which is usually of minor importance in the northern States but in 1931 did considerable damage to cucurbits in Maryland and Ohio and in Connecticut, where it was recorded for the first time ; *Tibicen* (*Tibicina*) *septemdecim*, L., brood V of which was centred in West Virginia and eastern Ohio and appeared in large numbers over practically its entire range ; and *Popillia japonica*, Newm., which was collected during the summer at several places outside the previously known infested areas.

Bruchus brachialis, Fhr., is recorded for the first time from the United States, where it was taken on vetch in several localities. *Phthorimaea* (*Gnorimoschema*) *lycopersicella*, Busck, was found for the first time in Pennsylvania, where the larvae destroyed the buds of tomatos both under glass and in the field. It had previously been reported only from the Pacific coast, where it occasioned a 40 per cent. loss to the tomato crop in one locality in California in 1930, and has been known as a pest of tomatos for a number of years in Mexico. The Coreids, *Alydus pilosulus*, H.-S., and *A. eurinus*, Say, were found to be seriously injuring lima beans in east-central Georgia late in July. The injury resulted from feeding punctures in the pod and the consequent loss of sap from the developing seeds. Although well-distributed throughout the United States and occurring from New England southward to Florida and westward to California, neither species had previously been recorded as of economic importance. Larvae of *Euptoieta claudia*, Cram. (variegated fritillary) destroyed soy-beans, snap beans, maize, sweet potatoes and cowpeas during July in eastern Tennessee in fields having a considerable growth of passion flower vine [*Passiflora*], which seems to be the preferred food-plant. Late in September the larvae were collected on privet (*Ligustrum*) in Mississippi. *Engytatus geniculatus*, Reut., is recorded for the first time as a pest of tomatos in the United States, several reports of injury being received from California during midsummer.

Eucosma gloriola, Hein. [*R.A.E.*, A, xx, 86] was found to be generally abundant in the lateral shoots of *Pinus strobus* in Connecticut, causing a considerable amount of injury. Moths emerged during the early part of May 1931 from larvae collected during early July 1930. *Tortrix* (*Cacoecia*) *conflictana*, Wlk., has been known for a number of years as a pest of poplar in Western Canada, but seems to be a comparatively new pest in the United States. It was reported in 1931 to have defoliated about 43,000 acres of poplar in the Moosehead Lake district of Maine, where the adults were in flight in the last week in June and another brood of larvae were feeding on the poplars by the middle of July. Serious injury was caused to gladiolus in both field and greenhouse in Massachusetts, New York, Ohio and Pennsylvania during July, August, September and October by *Taeniothrips gladioli*, Moult. & Steinw. *T. atratus montanus*, Priesner, was also collected in Massachusetts on gladiolus bulbs, this being the first record of this European thrips in North America. *Tortrix ivana*, Fern., which has hitherto been recorded only from Florida, where it was reared from *Iva imbricata*, was reported during August 1931 attacking the leaves of roses on Long Island.

Swezey (O. H.). **Summary of Insect Conditions in Hawaii for 1931.**—*Insect Pest Surv. Bull.*, xi, no. 10, pp. 680–681. Washington, D.C., U.S. Dept. Agric., Bur. Ent., 1931.

Most of the pests recorded in this summary have already been noticed [*R.A.E.*, A, xviii, 252, 254, 588 ; xx, 22, etc.]. The sugar-cane leafhopper, *Perkinsiella saccharicida*, Kirk., of which an outbreak covering 200 acres occurred in early summer, was well controlled by natural enemies, including the egg-sucking bug, *Cyrtorhinus mundulus*, Bredd. Larvae of *Anomala orientalis*, Waterh., caused injury to the roots of sugar-cane on one plantation. They were eventually controlled, however, by *Scolia manilae*, Ashm. *Heliothis obsoleta*, F.,

which is not usually a pest of maize in Hawaii, was very injurious to it in 1931, 50 per cent. or more of the green ears being found infested. A leafhopper, *Empoasca* sp., which has been present for about 13 years on the Islands, feeding chiefly on *Amarantus* and other weeds, was very destructive to melons in one region in 1931. *Agromyza virens*, Lw., which was first observed in Honolulu in 1928, the larvae living in the stems of *Zinnia*, is now widely distributed and becoming more destructive in gardens. *Hibiscus* hedges are increasingly infested with *Pinnaspis* (*Hemichionaspis*) *minor*, Mask., which also attacks many other shrubs.

GROSSMAN (E. F.). **Methods for making Counts of Boll Weevil Infestation.**—*Bull. Florida Agric. Expt. Sta.*, no. 241, 22 pp. Gainesville, Fla., November 1931. [Recd. February 1932.]

The following is taken from the author's conclusions. A survey of half an acre of a field of cotton, in which all squares on all plants were examined, indicated that the greater the number of squares examined, the more closely the estimated percentage of infestation by *Anthonomus grandis*, Boh., approaches the actual degree of infestation of a lightly infested field. Heavily infested fields, however, require the examination of relatively few squares. Of the various methods of determining the degree of infestation, that of making estimates from 20 plants at random is as satisfactory as any other and involves comparatively little labour. The determination of the number of boll-weevils in a sparsely populated field is attended with great errors, regardless of the method employed.

LEONARD (M. D.). **Notes from Annual Report on Insect Conditions in Porto Rico, July 1, 1930 to June 30, 1931.**—*Insect Pest Surv. Bull.*, xi, no. 10, pp. 682–685. Washington, D.C., U.S. Dept. Agric., Bur. Ent., 1931.

Insects causing economic injury in Porto Rico during the period 1st July 1930–30th June 1931 included the Jassid, *Agallia albidula*, Uhler, which was common on water-melons and had not before been definitely recorded from Porto Rico ; *Cerotoma denticornis*, F., which was fairly common on beans during March and April, without apparently doing much damage ; *Cicadella sirena*, Stål, attacking okra [*Hibiscus esculentus*] ; *Conchaspis angraeci*, Ckll., which was found heavily infesting the branches of an undetermined tree, having previously been recorded only on vanilla and ornamental croton ; *Corizus hyalinus*, F., adults of which were collected from egg-plant leaves, previously recorded only as being abundant on weeds ; the weevil, *Exophthalmodes roseipes*, Chevr., which caused injury to foliage and fruits of *Citrus* ; and *Leptoglossus gonagra*, F., which caused considerable injury to grapefruit in the latter part of November and December, the bugs being present in enormous numbers and breeding in the wild balsam apple (*Momordica charantia*).

CALDERON (S.). **Insect Conditions in Salvador, Central America.**—*Insect Pest Surv. Bull.*, xi, no. 10, pp. 686–688. Washington, D.C., U.S. Dept. Agric., Bur. Ent., 1931.

This brief review of insects attacking plants in Salvador includes the following species causing injury to coffee : the Lamiid, *Hammoderus spinipennis*, Thoms., which bores into the stems, especially of young bushes ; *Idiarthron subquadratum*, Sauss & Pict., which cuts the young

twigs, leaves and fruit ; *Auximobasis coffeaella*, Busck, the larvae of which attack the seeds both in the field and when stored ; *Leucoptera coffeella*, Guér. ; *Saissetia hemisphaerica*, Targ., which is at times abundant on coffee ; and *S. nigra*, Nietn., which is found on *Coffea liberica* and *Eugenia malaccensis*.

Other injurious insects recorded include : *Toxoptera aurantii*, Boy., on limes ; *Cotinis texana*, Csy. (*mutabilis*, G. & P.) on *Citrus* ; *Anastrepha serpentina*, Wied., on avocados and mangos ; *Rhynchophorus palmarum*, L., which attacks the buds of dying coconut palms and is possibly a secondary pest ; *Rhina barbirostris*, F., which bores in the terminal buds of coconuts and coyol palms (*Acrocomia vinifera*) and may be secondary to bacterial or fungus attack ; *Azochis gripusalis*, Wlk., the larva of which bores in the terminal branches and buds of fig (*Ficus carica*) ; *Cosmopolites sordidus*, Germ., on banana ; *Dysdercus ruficollis*, L., *D. obliquus*, H.-S., *D. mimulus*, Hussey (*mimus*, auct.), *D. flavolimbatus*, Stål, *D. mimus*, Say (*albidiventris*, Stål), *Alabama argillacea*, Hb., *Laphygma frugiperda*, S. & A., *Rhodoneura terminalis*, Wlk., *Tomaspis inca*, Guér., *Cicadella pulchella*, Guér., and *Oncometopia undata*, F., all on cotton ; *L. frugiperda*, *Pantomorus femoratus*, Sharp & Champ., and *Remigia punctularis*, Hb. (*Mocis repanda*, auct.) on maize ; *Pyrota rugulipennis*, Champ., *Taeniopoda aurantia*, Brun., and *Schistocerca paranensis*, Burm., on beans ; *Pieris elodia*, Boisd., and *P. monuste*, L., on cabbage ; the ants, *Eciton coeca*, Latr., and *Ectatomma ruidum*, Roger, on ground-nuts ; *Feltia annexa*, Treit., on tobacco ; *Bruchus obtectus*, Say, and *Spermophagus* (*Zabrotes*) *pectoralis*, Sharp, in stored beans ; and *Calandra* (*Sitophilus*) *oryzae*, L., in stored maize. The larvae of *Plodia interpunctella*, Hb., live in the pulp of ripe coffee berries without damaging the seed.

Gaudron (J.). **La Gusanera del zapallo, de la calabaza, del melón, de la sandía y de otras cucurbitaceas afines.** [The Larva infesting Pumpkin, Melon, Water-melon and other similar Cucurbits.]—*La Vida agric.*, viii, no. 97, pp. 835–838, 2 figs., 1 ref. Lima, 1st December 1931.

Since 1919 the larvae of the Pyralids, *Diaphania nitidalis*, Stoll, and *D. hyalinata*, L., have constantly infested various cucurbits near Lima. Pumpkins seem to be the preferred food-plant, and water-melons offer most resistance to attack. The complete life-cycle requires only 4–5 weeks during the warm part of the year, and hibernating pupae probably occur in winter. A calcium or lead arsenate dust may be used against the young larvae of *D. hyalinata*, which feed on the foliage before entering the fruits. Otherwise both pests can be combated only by such measures as the clearance of all débris, etc., after the harvest, followed by deep ploughing to bury any remaining pupae ; growing rows of pumpkins among the principal crop as a trap ; ensuring early ripening of melons and water-melons before the spring larvae become abundant ; and enclosing the fruits in paper bags.

Una nueva peste de la Caña de Azucar en la Costa Peruana. [A new Pest of Sugar-cane on the Peruvian Coast.]—*La Vida agric.*, viii, no. 97, pp. 839–840, 1 fig. Lima, 1st December 1931.

A decree dated 19th November 1931 declares the coastal valleys of Chillón and Rímac in Peru to be infested by the weevil, *Metamasius hemipterus*, L., which has long been known as a pest of sugar-cane in the Montaña region [*R.A.E.*, A, xvi, 251].

GILLIATT (F. C.). **Four Years' Observations on the Eye-spotted Budmoth, *Spilonota ocellana* D. & S., in Nova Scotia.**—*Sci. Agric.*, xii, no. 6, pp. 357–371, 3 pls. Ottawa, Ont., February 1932.

Eucosma (*Spilonota*) *ocellana*, Schiff. (eye-spotted budmoth) is of European origin but has been known for over 90 years in North America, where it is now present in practically all the temperate fruit-growing regions. Outbreaks occur at intervals, and in the concentrated orchard areas of Nova Scotia, where it was first recorded in 1885, may last 3–5 years.

An account is given of the results of investigations begun in 1926, including biological investigations in the insectary in conjunction with observations in the field. Much of the information is similar to that already noticed from Nova Scotia and the United States [*R.A.E.*, A, xvi, 143 ; xvii, 91, 270, etc.]. The females emerge two or three days after the males ; those emerging late in the season are smaller and of lower fecundity than those emerging earlier. The eggs are laid promiscuously on both sides of the leaves, the surface apparently varying in different regions and for different years. The larvae usually pass the winter in the fifth instar and apparently tend to hibernate when a certain stage of development has been reached, irrespective of the prevailing temperature. They emerge in the spring over a period of 2–3 weeks, according to the season and the stage of development of the buds on the different varieties of apple. Just previous to emergence the hibernaculum is thin and tender, and the exit hole is made several days before conditions are favourable for emergence ; there is, therefore, a period of 4–10 days when the larvae could be killed within the weakened hibernacula by certain contact sprays. There is a certain amount of larval mortality during the winter.

In Nova Scotia *E. ocellana* is a pest of well cultivated orchards. Apple trees growing in waste land or otherwise neglected, even though adjacent to infested orchards, are not seriously attacked. Orchards in exposed situations are apparently as readily attacked as those in more protected ones. It appears that some of the methods of cultivation of orchards disturb the balance of natural control in relation to this moth and its environment and favour its increase. Dusting with sulphur or Bordeaux mixture, and to a less degree spraying with the latter, appear to have an adverse effect on natural control. Dipterous and Hymenopterous parasites of the larvae were less numerous in orchards where spraying was a general practice than in those that received no treatment. The egg parasite, *Trichogramma minutum*, Riley, was prevalent in 1926 and 1927 and greatly reduced the numbers of *E. ocellana* ; it was very scarce, however, in the two following seasons.

[YAKUSHEV (M. R.).] **Якушев (M. P.). Observations on *Tipula* in the Government of Smolensk.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 4–6, pp. 219–225. Leningrad, 1931. [Recd. January 1932.]

An account is given of observations on *Tipula oleracea*, L., carried out during an outbreak in the summer of 1929 in the Smolensk Government [*cf. R.A.E.*, A, xx, 87]. Especially severe damage was caused to young flax in late May and early June, and to cabbage seedlings, though clover, meadow grass, oats and barley were also attacked. The character of the injury caused is described. In several instances mass

migrations of the larvae from clover and meadows to flax were observed. Flax following potatoes was much less infested than when sown in former meadows or clover fields. Permanent breeding reservoirs were found in waste land covered with bushes and having a heavy and rather damp soil. A table is given showing the number of larvae to a unit area in various types of soil, low damp places and clay soils being definitely preferred and sandy ones avoided. Pupae occurred in the soil from mid-June till mid-August.

The control measures recommended include preservation of rooks; cultivation of resistant crops in former clover fields; late sowing; and trap ditches 10 ins. deep to prevent migration of the larvae.

[Popov (P. V.).] **Попов (П. В.). Some Notes on the Biology of *Euxoa segetum* Schiff.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 4–6, pp. 227–234, 1 diag., 2 refs. Leningrad, 1931. [Recd. January 1932.]

This is an account of observations on *Euxoa segetum*, Schiff., in the summer of 1926 in the Saratov Government, chiefly under laboratory conditions, as it was rather scarce in the field. In nature, the adults of the first generation were on the wing from 8th to 30th June, being comparatively abundant in the middle of the month. Those of the second generation were much less numerous, though the flight period lasted from 25th July to 11th September. At 17–29°C. [62·6–84·2°F.] females lived 12–23 days and males 8–17. Eggs were laid on all varieties of weeds that usually occur in fallow land, with a preference for those that are low and grow close to the soil. A list is given of the wild and cultivated food-plants. An hour's rain, even when the larvae were under a cover of vegetation, resulted in a high percentage of mortality of those of the first three instars from bacterial diseases; the fourth and fifth instar larvae survived.

Ploughing fallow land during, or soon after, the intensive flight of the adults in June and about the end of July would be of considerable value in control, as unfavourable conditions for oviposition are produced and young larvae are buried or die from lack of food. Parasites obtained from the larvae of the first generation were *Ophion luteus*, L., *Henicospilus merdarius*, Grav., *Amblyteles vadatorius*, Ill., and *Tachina larvarum*, L., but the rate of parasitism was only 2·3 per cent. In 1927 a single individual of *Phryxe vulgaris*, Fall., was reared from a larva.

[Filatova (T. P.).] **Филатова (Т. П.). Noctuid Larvae infesting Melons in the District of Semipalatinsk.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 4–6, pp. 235–238, 1 fig. Leningrad, 1931. [Recd. January 1932.]

For a number of years watermelons in the Government of Semipalatinsk (Western Siberia), where they are extensively cultivated, have been severely attacked by Noctuid larvae, so that the plantations had to be resown 4 or 5 times in many districts. Investigations carried out in 1927, 1928 and 1929 showed that the species concerned were *Euxoa tritici*, L., *E. conspicua*, Hb., and *Agrotis ravida*, Schiff. (*obscura*, Brahm), the larvae of the two last appearing in fallows about 24th April and those of *E. tritici* 10–12 days later. At first the larvae feed on weeds in waste land, but about the end of May they migrate to plantations of watermelons and attack the young tender stems and leaves. Feeding, which takes place at night, continues till

about 20th June, when pupation begins. Heavy and prolonged rains kill the larvae and may save the plants from complete destruction. Laboratory experiments in flooding the soil in pots in which larvae of various Noctuids were bred confirmed this observation, as those of *E. tritici* and *E. conspicua* were killed, whereas other species climbed on the plants and survived. The adults of *E. conspicua* were on the wing from 20th July, and those of *E. tritici* from the beginning of August till about 20th September. The number of mature eggs found in dissected females varied from 180 to 276. Some of the larvae were destroyed by parasites or diseases, and in 1929 40 per cent. of the pupae contained larvae of *Exoprosopa, Salmacia* or *Apanteles*.

In the Semipalatinsk Government, where the summer is very hot, poison baits are useless, as they quickly dry out, and constant strong winds erode the perpendicular walls of trap ditches, which thus cease to be effective. Sunflowers or pumpkins sown densely as trap-plants in a belt about 40 ins. wide round watermelon plantations and sprayed with a stomach insecticide proved to be an excellent protection ; in strips that were not sprayed, the larvae were successfully collected by hand.

[Pustovoĭt (A. F.).] **Пустовойт (А. Ф.). The Control of the Processionary Oak Moth, *Thaumetopoea processionea* L., in the District Pervomaisk, Government of Kherson, in 1927.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 4–6, pp. 239–243, 3 refs. Leningrad, 1931. [Recd. January 1932.]

In the summer of 1927 an outbreak of *Thaumetopoea processionea*, L., occurred in oak forests covering an area of about 9,500 acres in the southern Ukraine. Oaks were the only food-plant, and about 50 per cent. of the trees were infested, each harbouring 1–5 nests of the larvae. Oaks 60–80 years old were completely defoliated, whereas thinner trees, on which the larvae could not congregate in large numbers, were soon abandoned, though there was no lack of foliage. Feeding and migration occurred at night, the larvae resting by day in masses on the trunks and branches of the trees, often in several superimposed layers, the total weight of which sometimes amounted to 36 lb. The larvae massed under a cover of web only at the time of moulting ; after the third moult, however, they remained in the nest for pupation, which took place in early July. The adults were on the wing from 27th July to 5th August. In the infested districts quantities of the larval hairs floated in the air and caused serious irritation of the skin in man and swelling of the eyes in cattle. This irritation could be allayed by rubbing in damp salt or concentrated brine, which did not remove the hairs from the skin but neutralised the poison contained in them.

Control measures consisted in destroying the nests that harboured the larvae or pupae. The larval nests were first sprayed at high pressure with a mixture of 1 part benzine and 4 parts kerosene and then set on fire by means of torches attached to sticks. If the nests were too high, kerosene was sprayed on the bark in a narrow strip running from the web to the point where it could be reached. Burning proved ineffective, however, against nests containing pupae, as the latter were usually too deeply embedded in the web and the scorching of the surface of the nests did not kill them, while more thorough soaking and burning was dangerous to the trees. Nests containing pupae were

therefore pulled down with hooks on poles and destroyed on the ground. *Calosoma sycophanta*, L., was predacious on the larvae, and 21 per cent. of the pupae were parasitised by *Pimpla instigator*, F., 10·5 per cent. by *Zenillia* (*Exorista*) *libatrix*, Panz., and 0·5 per cent. by *Theronia atalantae*, Poda, which has not previously been recorded as a parasite of this moth.

[Rudnev (D. F.).] **Руднев (Д. Ф.). Notes on the Biology of *Cerambyx scopolii* Laich.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 4–6, pp. 245–248, 8 refs. Leningrad, 1931. [Recd. January 1932.]

An account is given of observations on *Cerambyx scopolii*, Fussl., carried out in the central Ukraine in the course of investigations on *C. cerdo*, L., in 1927–28 [*R.A.E.*, A, xvii, 147], in association with which it was often found, and continued in 1929. The life-cycle is completed in two years. The adults are on the wing from about 20th May till about mid-August, the maximum flight occurring in mid-June. The eggs are laid singly, deep in the cracks of the bark close to the bast, especially on stumps of trees that have recently been felled. Oak and hornbeam (*Carpinus betulus*) are preferred, followed by elm, maple and ash. The damage caused by the larvae to the bast and wood and the type of the galleries are described. Pupae occurred from the second half of July till the end of August, and the young adults, which were first found early in August, hibernated in the pupal cells.

As this beetle usually attacks unhealthy trees and particularly stumps, its economic importance is not great. As its numbers increase greatly in forests where large areas have been cleared and the stumps left unbarked, their bark should be removed either immediately after the trees had been cut to prevent oviposition, or at the end of the vegetative period to destroy the eggs.

[Borodaevskiĭ (P. P.).] **Бородаевский (П. П.). Notes on the Biology of *Pityogenes chalcographus* L.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 4–6, pp. 249–251, 1 fig. Leningrad, 1931. [Recd. January 1932.]

In view of the fact that *Ips* (*Pityogenes*) *chalcographus*, L., is a serious pest of spruce in Central Russia, a detailed description is given of the galleries it makes in the sap wood, and a comparison is made of the average lengths of the mother galleries of this Scolytid with those of *I. bidentatus*, Hbst. (*P. bidens*, F.) and *I.* (*P.*) *quadridens*, Htg., and the number of eggs deposited (which depends directly on the length of the gallery) by them and by *I.* (*Orthotomicus*) *starki*, Spess. *I. chalcographus* usually occurs at a distance of 3–6½ ft. from the base of felled spruces measuring 18 ins. in diameter near the stump and having bark 12 mm. thick, but also occurs on trees about 12 ins. in diameter with bark 4–5 mm. thick. The statement that pupation always occurs in the bark is incorrect, as it was found that about 20 per cent. of the larvae pupate under it, if it is 4–5 mm. thick. Trap logs of spruce 12–14 ins. in diameter should be used for both *I. chalcographus* and *I. typographus*, L. Of the 3343 beetles examined 46·6 per cent. were males. Counts of the numbers of young adults that emerged from pupal cells occurring on a given surface showed that about 92 beetles appeared from 16 sq. ins. of infested bark.

[Ostashchenko-Kudryavtzev (N. P.).] **Остащенко-Кудрявцев (Н. П.). Effect of Manuring on the Numbers of the Wire Worms in Sunflower Plantations.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 4–6, pp. 253–258, 1 ref. Leningrad, 1931. [Recd. January 1932.]

In the course of tests near Leningrad of the effect of various manures on sunflowers cultivated for fodder, their influence on larvae of different Elaterids that were numerous in the soil was also studied. It was found that the wireworms were abundant in plots treated with liquid nitrogenous manure of animal origin, whereas only a few occurred in those treated with solid dung.

[Belanovskiĭ (I.).] **Белановский (И.). Transmitting Agents in Insect Epidemics.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 4–6, pp. 269–278, 2 refs. Leningrad, 1931. [Recd. January 1932.]

This is a discussion, based entirely on the literature, of the part played by various diseases in the reduction of insect outbreaks, methods of research on them, and the possibility of their artificial dissemination. It is suggested that among the individuals of a species present in a given area there will always be a certain number that harbour a latent infection, and when unfavourable conditions break down the resistance of the organism, an epidemic is produced. The virulence of a disease may increase to a high degree after it has been transmitted a number of times. It is considered certain that in many cases often, and in some cases possibly always, transmission of these diseases is effected by parasitic or predacious insects.

[Starchenko (I. I.).] **Старченко (И. И.).** *Agrilus biguttatus* **Fab. in the Shipov Forest, Voronezh Government.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 4–6, pp. 303–306. Leningrad, 1931. [Recd. January 1932.]

In the summer of 1929 oaks in a forest in the Voronezh Government, practically all of which were drying up, were found to be infested by the larvae of *Agrilus biguttatus*, F. Observations showed that this Buprestid has one generation a year, though under unfavourable conditions development may be more protracted. Hibernation occurs in the larval stage. In 1929 pupation started on 9th May, and the mass emergence of the adults occurred on 4th June. The larvae congregated chiefly in the basal part of the trunk, probably because it retained a certain amount of moisture, which apparently is necessary for their development ; it was found that they move down the trunk as the drying of the tree progresses.

[Stark (N. K.).] **Старк (Н. К.). The Insect Fauna of different Forest Types.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 4–6, pp. 339–343. Leningrad, 1931. [Recd. January 1932.]

The importance of knowing the insect pests that are invariably associated with certain types of forest is pointed out, and the results are given of investigations on bark-beetles carried out in this connection in 1927–29 in the Bryansk Government. The technique of the work is described. Calculations of the average number of mother galleries

occurring in trees either standing or on the ground in a given area indicated a certain regularity in the occurrence of different pests in the various types of stands. *Myelophilus* (*Blastophagus*) *minor*, Htg., was decidedly more numerous than *M.* (*B.*) *piniperda*, L., in pine forests on sandy ground and in mixed stands of pine and spruce situated in places with deep subsoil water, whereas *M. piniperda* predominated in mixed stands on damp ground and in the vast majority of cases displaced *M. minor*. *Ips typographus*, L., was abundant and more numerous than *I.* (*Pityogenes*) *chalcographus*, L., and *Polygraphus poligraphus*, L., in damp mixed stands of spruce and deciduous trees. Though *Dryocoetes autographus*, Ratz., which attacked spruce only, *Hylastes* (*Hylurgops*) *palliatus*, Gyll., and *Xyloterus lineatus*, Ol., were present in both dry and damp forests, *Xyloterus* obviously preferred dry pure stands of pine or spruce, and *Hylastes* did not occur in pine forests on sandy ground.

[Vuirzhikovskaya (A. V.).] **Выржиковская (A. B.). On the Damage caused by *Cephus pygmaeus* L.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 4–6, pp. 365–369, 8 refs. Leningrad, 1931. [Recd. January 1932.]

In the Voronezh Government in 1928, spring sown wheat was no less infested by *Cephus pygmaeus*, L., than winter wheat and rye, probably owing to its abundance and protracted flight period. The grain in the infested plants, including rye, on which observations have not previously been made, lost considerably in weight. No preference was shown for better developed or thicker stems [*cf. R.A.E.*, A, xix, 22]. The infestation was much more severe in fields that were sheltered by strips of forest, the percentage being in some instances four times as high as in crops cultivated in the open.

[Stark (V. N.).] **Старк (B. H.). The Organisation of Research Work in Forest Entomology.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 4–6, pp. 411–418, 2 refs. Leningrad, 1931. [Recd. January 1932.]

Attention is called to the enormous damage caused by insect pests to forests in the Russian Union, and a table is given showing the distribution of various species, chiefly bark-beetles, with an indication of the extent of the areas infested. The lack of sufficient knowledge of forest pests in Russia and of the causes of their outbreaks is briefly discussed, and proposals are made for the organisation on a large scale of research work on forest entomology, based on a uniform plan and under centralised direction.

Aristov (M. T.). **Ueber die Schädlichkeit des Apfelblütenstechers.** [On the Injuriousness of the Apple Blossom Weevil.]—*Anz. Schädlingsk.*, vii, nos. 11–12, pp. 121–128, 139–143, 6 figs., 19 refs. Berlin, 15th November, 15th December 1931.

Reference is made to the conflicting views on the economic importance of *Anthonomus pomorum*, L. [*cf. R.A.E.*, A, xix, 615, etc.]. From the investigations described here, which were made in two localities in Russia that are ecologically widely different, the author concludes that only 20 per cent. of the apple blossoms produce fruit, and attack by *A. pomorum* makes itself felt only when it destroys more than 80

per cent. A blossom loss of 50 per cent. has no effect on the crop yield, and the weevil chooses the young blossoms for oviposition (as this ensures the egg being hatched before the blossom is fully open) and not those parts of the cluster that have the greatest chances of producing fruit. It may, however, be injurious in districts where spring progresses slowly and both blossom development and oviposition are protracted.

Blunck (H.). *Psylliodes affinis* **Payk. an Tabak** [on Tobacco].—*Anz. Schädlingsk.*, vii, no. 12, pp. 133–136, 1 fig., 19 refs. Berlin, 15th December 1931.

The occurrence in Germany of the potato flea-beetle, *Psylliodes affinis*, Payk., on *Nicotiana affinis*, suggested feeding experiments with 40 solanaceous plants, including 11 species of *Nicotiana*. Of these, some were readily attacked, while others were rejected. As a rule the feeding decreases as the nicotine content increases. Though lacking nicotine, *N. glauca* was not attacked, probably because of the structure of the leaf-tissue and cuticle.

Nagel (W.). **Dipyridyle zur Schädlingsbekämpfung.** [Dipyridyls in Pest Control.]—*Anz. Schädlingsk.*, vii, no. 12, pp. 137–139, 2 figs., 3 refs. Berlin, 15th December 1931.

Other workers have shown that dipyridyls may exhibit varying degrees of toxicity to insects [*R.A.E.*, A, xv, 140; xix, 100]. In the author's experiments two German preparations, a dipyridyl sulphate containing 40 per cent. dipyridyl and giving an aqueous solution, and a dipyridyl mixture containing 80 per cent. and producing an aqueous emulsion of almost unlimited keeping power, were compared with 40 per cent. nicotine sulphate, larvae of *Ephestia kühniella*, Zell., being dipped for 30 seconds in the fluids. The dipyridyl sulphate was less toxic than the nicotine sulphate, which, at 2 per cent. strength, caused 70 per cent. mortality, but the dipyridyl mixture at 1 per cent. strength produced a mortality of 90–100 per cent. The keeping quality of Bordeaux mixture is not affected by the addition of dipyridyl mixture. Larvae of *E. kühniella* were all killed by the combination of Bordeaux and dipyridyl mixture containing 2 per cent. dipyridyl. With 1 per cent. there was a mortality of 90 per cent., but the larvae recovered with 0·5 per cent. The dipyridyl mixture might in certain circumstances replace the much more costly nicotine sulphate.

Sprengel (L.) & Sonntag (K.). **Der Flug der Kirschfliege** (*Rhagoletis cerasi* **L.) in seiner Bedeutung zu Fruchtreife und Witterung, mit grundsätzlichen Erörterungen über die Erfassung der Wetterfaktoren.** [The Flight of the Cherry Fly in Relation to Fruit Maturation and Weather, with a fundamental Discussion on the Appreciation of Weather Factors.]—*Anz. Schädlingsk.*, viii, no. 1, pp. 1–10, 8 figs. Berlin, 15th January 1932.

A detailed account is given of investigations on *Rhagoletis cerasi*, L., made in 1931 in the Palatinate in order to ascertain the progress of the flight period, the stage of the ripening cherry in which oviposition occurs, and the degree in which flight is connected with temperature or other meteorological factors. Males occurred from 18th May to 13th July, and females from 20th May to 10th July. On 31 days males

predominated, on 10 both sexes were equally represented, and on 11 females predominated. By 25th May the stones of some cherries were mature and attached to the pulp, and a few eggs were seen. By 1st June the pulp had become softer and juicier and had partly lost its dark green colour ; such cherries often contained eggs. From then onwards eggs and maggots were regularly found. Females thus began ovipositing 9–10 days after the beginning of the flight period. This relation between maturation of the fruit and oviposition renders it possible to fix the correct date for beginning control.

Temperature is important as regards adult emergence. In the laboratory flies emerged in 14 days from pupae kept at 22°C. [71·6°F.]. At 18°C. [64·4°F.] 24 days were necessary and at 28°C. [82·4°F.] only 4. In nature the temperature of the ground will vary according to environment, so that the adults will not all appear at once. In observations on the weather between 18th May and 13th June adults were captured in warm, dry weather. Rain resulted in very small catches, and the flies were almost inactive when the leaves were wet owing to rain at night or the air was cool and damp. The duration of actual sunshine did not have any positive effect, but catches were never large on days when sunshine was absent or only momentary. It is pointed out that the correlation between temperature and the activity of the flies only shows that temperature indicates the relative suitability of the general state of the weather. It is possible that the abundance of insects may actually be determined by weather elements that cannot be gauged by present methods.

ZACHER (F.). **Der Kabinettkäfer.** [The Carpet Beetle.]—*Mitt. Ges. Vorratsschutz*, viii, no. 1, pp. 3–6, 8 figs. Berlin, January 1932.

Females of the carpet beetle, *Anthrenus verbasci*, L., which has recently become a serious pest in Berlin and Stuttgart, lay from 20 to 100 eggs, preferably on furs or woollen materials. The larvae feed on various vegetable and animal substances, wool being usually preferred. The breeding-places include accumulations of dust, often containing wool fluff, and heaps of dead flies. Cracks in floors, etc., should be cleaned out and washed with a saturated solution of naphthalene in acetone, which is an inflammable mixture. Various fumigants are also recommended for control. It is stated by the makers of " Eulan " [*cf. R.A.E.*, A, xii, 576] that woollen fabrics are protected by it against this beetle.

LEHMANN (H.). **Beitrag zur Oekologie grasbewohnender Heteropteren Norddeutschlands.** [A Contribution to the Ecology of Grass-infesting Heteroptera of North Germany.]—*Z. PflKrankh.*, xlii, no. 1, pp. 1–10, 1 fig., 7 refs. Stuttgart, 1932.

Among the grass-infesting Heteroptera collected in 1931 near Landsberg, Prussia, *Aelia acuminata*, L., was the only Pentatomid commonly found, and *Corizus* (*Rhopalus*) *parumpunctatus*, Schill., the only Coreid. The Lygaeid, *Nysius thymi*, Wolff, was abundant in one instance, but cannot be regarded as of general occurrence in this region. Capsids predominated, the most common being *Notostira erratica*, L., and *Adelphocoris lineolatus*, Goeze ; the latter was usually associated with *A. seticornis*, F. *Lygus pratensis*, L., was not numerous, though widespread, *Trigonotylus pulchellus*, Hahn, being more

abundant. Species of *Stenodema* were also common. The only injury observed was that caused to the leaves by feeding ; but the author considers that the Capsids might cause more serious and lasting injury by oviposition punctures at certain times of the year, and he discusses this question in some detail.

ANDERSEN (K. T.) & SCHAEFFLER (—). **Spitzmäuschen (*Apion virens* Hbst. und *Apion seniculum* Kirby) as Kleeschädlinge.** [*A. virens* and *A. seniculum* as Pests of Clover.]—*Z. PflKrankh.*, xlii, no. 1, pp. 18–28, 3 figs, 5 refs. Stuttgart, 1932.

A detailed account is given of a serious local infestation of clover in Bavaria in 1930 and 1931 by the weevils, *Apion virens*, Hbst., and *A. seniculum*, Kby. The infestation was heavy, an average of 21 adults of *A. virens* and 5 of *A. seniculum* per plant emerging in 1931 from 5 caged plants. The larvae feeding in the plants check their growth so that the yield in fodder or seed is much decreased, and the plants sometimes die. Those of *A. virens* live in the tap-root and root-collar, while those of *A. seniculum* occur in the stems, in which they mine downwards. At the date of pupation the larvae of the two species are close to each other. The pupal stage lasted about 6 days at a summer temperature of 21·5°C. [70·7°F.], but at 13°C. [55·4°F.] it required about 3 weeks. The adults remain in the plants until their elytra have hardened so that at 21·5°C. they appear about 10 days after pupation. In 1931 the adults of both species emerged between 29th June and 16th July, *A. seniculum* a little later than *A. virens*. The date of oviposition by these adults could not be ascertained, and only one couple was seen mating, in late autumn. By mid-November the adults of both species had entered the soil to a slight depth in order to hibernate.

SCHWERDTFEGER (F.). **Beobachtungen und Untersuchungen zur Biologie und Bekämpfung des Kiefernspanners während des Frassjahres 1929 in der Letzlinger Heide.** [Observations and Investigations on the Biology and Control of the Pine Geometrid in 1929 in the Letzlinger Heath District.]—*Z. Forst- u. Jagdw.*, lxii, nos. 2–3, pp. 65–93, 133–166, 28 figs., 26 refs. Berlin, 1930. [Recd. January 1932.]

Observations on the pine Geometrid, *Bupalus piniarius*, L., were made from July to November in this district of Prussia, where over 13,000 acres of pine woods were infested in 1928 and about 15,000 acres in 1929. The emergence of the adults was not influenced by variations in air-temperature or rainfall, but weather affected their flight, which was most intense on sunny, warm, windless days and occurred especially between 9 a.m. and noon. Pines between 30 and 100 years old were most heavily infested, and the moths were most numerous in unmixed pine stands. Wind carried them about 2 miles in one case. They took wing at any noise, such as that of a motor hooter. The eggs were laid indiscriminately on the needles, except that the lower parts of the tree crowns seemed to be avoided. Trees densely covered with needles were preferred for oviposition. The collection of excreta was the method used to ascertain the abundance, size and development of the larvae in the crowns. Of the total amount of excreta, 10 per cent. was

obtained in August, 30 in September, and 60 in October, thus confirming the observation that injury usually becomes noticeable in October.

Various control measures were investigated. In areas where forest litter had been gathered in heaps, so as to destroy the pupae by exposure or by heat within the heaps, the excreta amounted only to 29–72 per cent. of the quantity in control areas. The effect of utilising pigs was uncertain [but *cf. R.A.E.*, A, xix, 724]. Burning over the forest litter resulted in a destruction of 88–92 per cent. of the pupae in one instance, but this measure is obviously of limited application. Arsenical insecticides applied with a power duster gave unsatisfactory results owing to physical causes, possibly currents of air around the needles or to the sieve-like action of the first trees encountered by the dust cloud. The method of dusting from the ground, in which the poison is carried laterally by the wind against the needles, appears to be unsatisfactory against *B. piniarius*, though the small amount of arsenic thus deposited might be sufficient against other pests, such as *Diprion* (*Lophyrus*), that are more susceptible to it [*cf.* xviii, 92].

Brunn (G.) & Schwerdtfeger (F.). **Die Bestäubung der Nonne in der preussischen Staatsoberförsteri Fuhrberg.** [Control of the Nun-moth by Dusting in the Prussian State Forestry District of Fuhrberg.]—*Forstwiss. Zbl.*, liii, no. 21, pp. 741–753, 7 figs., 22 refs. Berlin, 1st November 1931.

An experiment in dusting from aeroplanes against *Lymantria monacha*, L., was made in July 1928, about 2,500 acres of pine woods being treated with 54 tons of a proprietary insecticide containing 20 per cent. of calcium arsenate. Owing probably to cold, wet weather, the larvae had grown very slowly during May, and they did not pupate until about 25th July. Larvae on some spruce trees growing beneath or among the pines, however, grew more rapidly and pupated about 15th July. Judged by the amount of excreta, feeding increased with a rise in temperature. The effect of the dusting, as measured by collections of excreta, was general and noticeable in 24 hours after treatment. The result was satisfactory and proved the great susceptibility of *L. monacha* to calcium arsenate. The third instar larvae are those most affected, because they feed more. Areas left undusted for comparison should be on the edges of treated areas and as square in shape as possible, so as to ensure the centres being free from dust carried by wind.

Borchert (A.). **Untersuchungen an der Acarapismilbe.** [Investigations on the *Acarapis* Mite.]—*Z. Parasitenk.*, iv, no. 2, pp. 331–368, 10 figs., 14 refs. Berlin, 28th January 1932.

By comparing numerous measurements obtained from 555 males and 1,242 females of *Acarapis* from bees from various European countries, the author concludes that *A. externus*, Morgenthaler, is not specifically distinct from *A. woodi*, Rennie, though it may represent a biological race [*cf. R.A.E.*, A, xix, 736, etc.]. Sulphur dioxide, in concentrations too weak to harm the bees, caused a marked reduction in the numbers of the external form of the mite.

FULMEK (L.). **Der "Kohlerfloh" als seltsamer Rebenschädling.** [The Cabbage Flea-beetle as a rare Pest of Grape-vines.]—*Das Weinland*, 1931, no. 9, p. 289. (Abstract in *Neuheiten Geb. PflSchutzes*, 1931, no. 6, p. 172. Vienna, December 1931.)

In July 1931 the leaves of grape-vines in two localities in Austria were injured by *Haltica oleracea*, L. Many of the flea-beetles were found dead beneath the vines after spraying with Bordeaux mixture containing 2 per cent. tobacco extract and 0·12 per cent. Urania green.

MESNIL (L.). **Récoltes de Muscides nuisibles aux céréales.**—*Rev. Path. vég. Ent. agric.*, xviii, no. 8–9, pp. 266–274. Paris, 1931.

The most important Dipterous pest of cereals in France is *Oscinella frit*, L., of which *O. pusilla*, Mg., is considered a variety. There are normally three generations in a year, the larvae of the spring one living in the centres of oat or wheat plants and, more rarely, of rye or barley. They descend to the terminal shoot, where they make irregular winding galleries. In cases of heavy infestation 3 or 4 larvae may be found together; the centre is yellow and generally throws out suckers before drying up. The adults appear in the first half of June and oviposit in flowers of various cereals, especially barley. The infested grains turn yellow, while others on the same ear are green; in the case of oats, they whiten before the others without always becoming atrophied, their size remaining normal although they may contain a larva or pupa. Ears of wheat have their spikelets more and more whitened and atrophied towards the summit. The third generation eggs may be laid in autumn on winter grain sown too early (before the end of October), and the larvae frequently do heavy damage. Oviposition, however, generally occurs on weeds in the field before cultivation begins, and the larvae hatch in the soil and migrate to young cereals, which are killed before they have time to tiller.

Chlorops taeniopus, Mg., is abundant in the larval stage on barley, on which it produces galls, and less numerous on wheat, in which it mines without producing a gall. *Meromyza saltatrix*, L., of which *M. nigriventris*, Macq., is considered to be the melanic winter form, is also very abundant. It lives during the winter, like *O. frit*, in the centre of cereal plants sown too early, but only attacks wheat. The adults emerge at the end of May and belong to the melanic form far more frequently than to the type form. They oviposit on wheat at the moment of ear formation, the young larvae attacking the new ears, generally at the tips; as, however, the larvae grow much more slowly than the ears, the latter continue to develop, only the last spikelets being atrophied. The adults emerge in July–August and are quite different from those appearing in spring, although all intermediary forms are common. The author considers *M. ceralium*, Reut., described from Finland, to be identical with this summer form of *M. saltatrix*. Becker considers it to be *M. variegata*, Mg., but Reuter described the characters differentiating *M. cerealium* from *M. variegata* (*laeta* Mg.). *Lasiosina cinctipes*, Mg., is extremely common in various regions of France, the larva living during June in ears of barley of which the stalk is already infested by *C. taeniopus*. *Elachiptera cornuta*, Fall., caused considerable damage at Versailles in June 1931, the larvae occurring in young oat plants and occasionally in wheat. *Balioptera combinata*, L., lives through the winter in young wheat plants, the adults appearing at the beginning of spring and larvae of a

second generation being found on late-sown cereals in July. *Opomyza florum*, F., was taken in large numbers from wheat plants bearing 5 or 6 leaves, at the beginning of April, the adults emerging at the end of May.

Hydrellia griseola, Fall., which is polyphagous and attacks all cereals, is very abundant at Versailles. There are apparently two generations a year. The winter is passed as a pupa or more frequently as a larva, and the adults emerge at the beginning of spring. The larvae of the next generation pupate at the end of June, and emergence occurs at the beginning of July, the adults ovipositing on the new growth, especially of barley and oats. The young larvae mine in the outer leaves, 2–3 being sometimes found in a single leaf of barley in summer ; at the beginning of spring very young plants may be killed. *Hylemyia coarctata*, Fall., has been very scarce in recent years, but has been recorded at Versailles on winter wheat. A number of large larvae mining stems of spring wheat from the end of May until 10th June, when they pupated, are tentatively recorded as *Phorbia* (*Adia*) *genitalis*, Schnabl, and a larva that was abundant in winter on cereals is considered to be *Chloropisca glabra*, Mg. [*cf. R.A.E.*, A, xii, 129], although it may be *C. notata*, Mg.

Very brief notes are given on flies recorded by other authors as attacking cereals, and on some that have not been found on cereals but infest grasses.

Trouvelot (B.) & Thenard (J.). **Remarques sur les éléments des végétaux contribuant à limiter ou à empêcher la pullulation du** *Leptinotarsa decemlineata* **Say sur de nombreuses espèces ou races végétales.**—*Rev. Path. vég. Ent. agric.*, xviii, no. 8–9, pp. 277–285, 2 pls., 5 refs. Paris, 1931.

Under natural conditions, the larvae of *Leptinotarsa decemlineata*, Say, only attack solanaceous plants, usually species of *Solanum*. The cause of the susceptibility of certain plants was investigated at Charente during 1931, with a view to finding varieties of potato less liable to attack than those at present cultivated. It was observed that on *Solanum* spp., young larvae, after feeding a little on the leaves on which they hatch, migrate to the main stem and finally congregate on the terminal buds. On *Lycopersicum*, where the stalks in the neighbourhood of the young shoots are generally covered with long, stiff hairs, mixed with shorter glandular ones, the larvae find movement very difficult, become exhausted and drop off at the slightest disturbance. They are very unlikely to find another favourable plant, and rain or the heat of the sun frequently kills them. By placing small circlets of the outer skin of stalks of *Lycopersicum* round those of potato, the same results are obtained, about 70 per cent. at least of the larvae disappearing from the plants. Young larvae attack the leaf tissues of *Lycopersicum* and obtain food for development for a certain time, but they move about much more on these leaves than on those of *S. dulcamara*, *S. nigrum* or potato (*S. tuberosum*). This greater movement, with the consequent dropping off of many larvae, seems to be correlated with the abundance of hairs terminating in glands that occur on these leaves. On *Nicotiana*, the movement of larvae is greatest on those varieties that have glandular hairs. The converse, however, is not true in all cases ; smooth leaves are not always those on which there is least movement or on which the attack is most

severe, and there are evidently other factors to be considered. When larvae are placed on leaves of beans (*Phaseolus vulgaris*), which they frequently attack in captivity, especially after fasting, they feed for a short time but die within 36 hours. Microscopic examination of these leaves reveals rows of short, thick hairs, ending in sharp, pointed hooks on the lower surface and along the veins. These prevent any movement of the larvae, which generally die exhausted by the effort to free themselves. The upper surface of the leaves is smoother, and the stronger larvae can survive there for several days. If a circlet of *Phaseolus* leaf is placed round stems of potato, the larvae die in numbers, caught in these hairs, or fall to the ground in the attempt to free themselves.

Chemical factors seem to influence the development of the larvae of *L. decemlineata* on certain plants ; for example, the larvae devour large quantities of the smooth leaves of *Petunia hybrida*, but die within 24 hours, their bodies being swollen and purple-coloured, indicating poisoning. On plants rejected by the larvae, death from starvation does not occur for 50–70 hours and the body shrivels. The same death from poisoning, though rather less rapid, occurs after feeding on certain species of *Nicotiana*.

The field for research on these factors that affect the development of *L. decemlineata* is a vast one, and the great variation in their occurrence in different species of *Lycopersicum* and *Nicotiana*, which are botanically closely allied to *Solanum*, indicate the possibility of developing their presence in varieties of potato.

DES ABBAYES (H.). **Sur une invasion de chenilles du** *Celerio livornica* **Esp. (Lépidoptère) en Vendée.**—*Bull. Soc. zool. Fr.*, lvi, no. 6, pp. 512–519, 1 map, 6 refs. Paris, 15th February 1932.

A number of final instar larvae of *Celerio lineata* var. *livornica*, Esp., which were very abundant in fields of buckwheat (*Fagopyrum tataricum*) in Vendée at the end of June 1931, were collected and fed on vine, which they readily accepted. Pupation occurred in July, and the adults all emerged between 26th August and 15th September. There was no indication of hibernation of the pupae, such as occurs in *C. euphorbiae*, L., which is indigenous in Vendée. The worn appearance of the spring swarms of the moths is further evidence of migration from the south of France or Morocco. A description of the larva is given.

DURAND (G.). **Apparition anormale du** *Celerio livornica* **Esp. et dégâts faits par sa chenille dans les champs de sarrasin.**—*Rev. zool. agric.*, xxx, no. 12, pp. 181–187, 1 ref. Bordeaux, December 1931.

A sporadic infestation of *Celerio lineata* var. *livornica*, Esp., probably originating from North Africa, occurred in Vendée, on the east coast of France, during the summer of 1931. This Sphingid, which habitually migrates northward, is only occasionally recorded so far beyond its normal limits [*cf.* preceding paper]. It is highly polyphagous, but shows a predilection for buckwheat (*Fagopyrum esculentum* and *F. tataricum*), which suffered a certain amount of damage, and also for vines. The moths appeared about 20th–28th May, oviposition occurred between 10th and 15th June and pupation was effected before 14th July. The adult, larva and pupa are described.

La piqûre du bois de chêne mis en oeuvre, causes, moyens de protection. —*Rev. zool. agric.*, xxx, nos. 11–12, pp. 174–180, 191–195, 2 refs. Bordeaux, November-December 1931.

A general account is given of the various beetles liable to bore into sawn or manufactured timber, particularly oak, in France, where they cause serious losses, and the methods by which they may be controlled. The chief species concerned are *Lyctus linearis*, Goeze, *L. brunneus*, Steph., which was imported in foreign timber and has been established in France for some years, *Anobium punctatum*, DeG. (*striatum*, Ol.), *Xestobium rufovillosum*, DeG. (*A. tessellatum*, Vill.) and *A. castaneum* var. *hirtum*, Ill. Newly-felled timber is not attacked by *Lyctus* until it has been drying for 6–9 months, whereas the Anobiids show a preference for old and very dry wood, such as seasoned timber and old furniture. Heat hastens the development of the beetles, whereas dryness retards it. In contrast to the Lyctids, which confine themselves to hardwoods, the Anobiids mine indifferently in the timber of conifers or deciduous trees. Brief life-histories of both groups of beetles are given.

Preventive measures recommended include felling the trees in winter and cutting them up in the following year ; the application of steam to the blocks where possible ; and ringing the bark in the season preceding felling. Care should be taken to exclude all doubtful wood from timber-yards and to keep all wood of inferior quality separately. Since sapwood only is subject to attack, all danger can be avoided by excluding it from use for flooring and woodwork. Wood-yards and stores should be kept scrupulously clean, all stocks should be re-piled annually and no suspected wood should be worked up. Stocks should be protected by fumigation with paradichlorobenzene or orthodichlorobenzene. Timber may be rendered immune by the application of varnishes or the injection of toxic substances such as tar derivatives. Beetles may be destroyed in cut timber already attacked by treatment with steam or hot air, or preferably by fumigation with sulphur or chloropicrin in hermetically sealed chambers. Where infestation exists in woodwork in buildings, the rooms should be fumigated with one of these substances.

GRINBERG (S.). **La lutte contre le *Cleonus punctiventris* en Roumanie.** —*Ann. Gembloux*, xxxviii, no. 2, pp. 80–82. Brussels, February 1932.

In Rumania, the organised cultivation of sugar-beet has only recently been carried out in the Danube valley, but the plants are severely attacked by *Bothynoderes* (*Cleonus*) *punctiventris*, Germ., and *Loxostege* (*Phlyctaenodes*) *sticticalis*, L. The adults of *B. punctiventris*, which is particularly injurious, appear between the middle and end of March and feed on the young beet as well as maize, oats, lucerne, etc. The latter, however, are able to resist the attack, whereas acres of beet seedlings may be destroyed in a very short time, so that the fields have to be re-sown, sometimes twice. Although beet is attacked at all stages, it is mainly seedlings with 2–4 leaves that are entirely destroyed. The attack is most severe on warm sunny days ; during wet weather the beetles remain hidden in the earth. Mating takes place from early May to mid-June, and the eggs are laid in the soil at a depth of about 8–12 inches. After oviposition the females die, but the males continue to feed until the end of June. The larvae hatch about the end of July

and feed on the roots of the beet, but do not cause much damage. They pupate in autumn, and the resulting adults hibernate in the soil.

In experiments on control barium chloride and Paris green proved ineffective, because their action was too slow, but good results were secured with a proprietary contact insecticide, the work with which is described in detail. Another method tried was the boring of holes around the plants with a pointed stake to the depth of 8 inches. The beetles fall in when they attempt to move about and are unable to escape provided that the sides of the hole are sufficiently smooth. Although effective, this method is not considered practicable for large areas of beet.

Castor-oil plants [*Ricinus communis*] grown in proximity to beet were also attacked by *B. punctiventris*. All the beetles feeding on them died, however, 10–15 being found dead daily around each plant, and observations showed that the sap of this plant is toxic to the beetle.

MERCET (R. G.). **Notas sobre Afelínidos (Hym. Chalc.), 4a nota.**—*Eos*, vii, no. 4, pp. 395–410, 5 figs. Madrid, 25th December 1931.

Eretmocerus mundus, sp. n., is described from Italy and Spain; it is a parasite of a species of *Aleurodes* infesting egg-plant (*Solanum melongena*). Keys are given to the known species of *Eretmocerus* and the European species of *Coccophagus*.

Reports received from Experiment Stations, 1930–31.—Med. 8vo, xi+241 pp., ill. London, Empire Cotton Growing Corp., 1932. Price 2*s*. 6*d*.

In these reports the cotton pests investigated at various Stations are discussed, as in previous years, many of the insects having been previously recorded [*R.A.E.*, A, xix, 292]. F. S. Parsons, with the collaboration of G. C. Ullyett, describes experiments at Barberton, South Africa, in the use of farm implements for destroying the pupae of the red bollworm [*Diparopsis castanea*, Hmps.] (pp. 14–21). Investigation showed that about 50 per cent. of the pupae in cotton lands occur in the upper 3 ins. of soil within the area covered by an inter-row cultivating implement and, except under extreme conditions of soil packing, were susceptible to being moved by it without injury to roots. Additional operations were undertaken with peg tooth, spring tine, and rigid tine cultivators. The superiority of the peg tooth implement in lifting the pupae to the surface was proved, and after a series of tests it appeared that an initial application of this cultivator followed by the use of the rigid tine cultivator at suitable times for subsequent operations gave the best results. Three operations at intervals of three weeks exposed 53 per cent. of the pupae inserted in the soil in careful simulation of field conditions; in a field, this would represent rather less than 26 per cent. of the pupae present. Experiments on the exposure of pupae by ploughing and the action of a deep grubbing implement gave negative results. Pupae exposed by implements during April, May and June for periods up to 54 days were not killed by heat, the highest temperature recorded at the soil surface being 117°F. During September, when temperatures at the soil surface were frequently between 130 and 138°, pupae exposed to the sun were desiccated, but those buried ½ inch below the soil surface were not killed.

Ants, including *Pheidole capensis*, Mayr, and *P. megacephala*, F., destroyed all pupae within 2 to 3 weeks of the date of exposure except during June, July and August, when they were inactive; these two species are abundant in all the low veldt cotton districts. Observations on the trap crops show a high positive correlation between the size of the plant and the number of eggs on it; size plus free fruiting is more attractive for oviposition than size vegetatively, and the indications are that the trap exercises attraction for some time after small plant cotton has produced buds. Cage work demonstrated that moths emerging a month prior to the appearance of buds on seedling cotton are capable of ovipositing on the seedlings, but if trap crops are present the moths will oviposit on them. Experiments with light traps [*cf.* xviii, 297] proved that acetylene flares of such candle power and cost as would not be prohibitive are not effective, and that paraffin lamps are less effective than acetylene flares Parasite records up to the present show 13 egg parasites (including *Trichogramma lutea*, Gir.) and 5 larval parasites.

The American bollworm [*Heliothis obsoleta*, F.] was active throughout the year; four egg parasites and six larval parasites have been recorded, of which the chief are *T. lutea* and an unidentified egg parasite, and the larval parasite, *Sturmia inconspicua*, Mg. In work on the mass-breeding of *T. lutea*, 8,000,000 were bred in the laboratory, about two-thirds of which were released. In the case of *D. castanea* it was found that approximately 90 per cent. of the host eggs were laid on positions on the plant where the development of hairiness was most considerable, and where it is apparently difficult for the parasite to reach them. The results with *H. obsoleta*, however, were encouraging, both on cotton, where the eggs are generally placed on leaf surfaces or other smooth parts, and on maize and beans.

The situation with regard to cotton stainers [*Dysdercus*] is discussed. In experiments with a spray for killing them on cotton-seed traps, on which they congregate when nothing but fruited bolls remain on the plants, 1 oz. of common laundry soap in a gallon of water was very effective when applied forcibly on to the masses of adults and nymphs on the seed heaps, by means of a bucket pump. Approximately 6 lb. of cotton seed were used to each heap, the seed being spread out to form a circle about 18 ins. in diameter. Three pints of spray were used to each heap, the resulting mortality being about 80 per cent. On 30 heaps, over an area of 6 acres, 105,000 stainers were killed by one spraying. It was not necessary to renew the seed heaps. Four unidentified Tachinid parasites of the stainers were found during the season.

From Southern Rhodesia (Gatooma), J. E. Peat reports upon the occurrence of bollworms (pp. 56–61). Extensive experiments were made with calcium arsenate dust on cotton plants, using about 5–7 lb. to the acre. There was no evidence, on comparing the dusted with undusted strips, that the dusting had been effective, but it may be that it played an important part in a rapid reduction in numbers of *H. obsoleta* ten days later. The cotton stainer chiefly in evidence was *D. fasciatus*, Sign.

Pests recorded from Northern Rhodesia (Mazabuka) by A. G. Bebbington and W. Allan (pp. 87–89) include the bollworms, *H. obsoleta* and *Earias insulana*, Boisd., the former causing heavy shedding of squares and young bolls, the stainers, *Dysdercus superstitiosus*, F., *D. fasciatus*, Sign., and *D. intermedius*, Dist., and *Callidea dregei*, Germ.

The most important alternate food-plant of these bugs is *Thespesia rogersi*. Continuous hand-picking of all stainers, combined with trapping over the effective period, reduced damage by 30 per cent., while continuous trapping resulted in approximately 24 per cent. reduction of staining. On the whole, plants growing on lighter soil gave a much higher and cleaner yield of seed cotton than plants of the same strain on heavier and darker soil. The plants on the darker soil were tall and bushy and retained their leaves throughout the season, whereas those on lighter soil were smaller and shed their leaves ; it is suggested that the difference in staining is due to difference in the numbers of stainers resulting from the varying amount of shade.

From Nyasaland (Port Herald Station), E. Lawrence (pp. 192–194) records that minor cotton pests were the Pentatomids, *C. dregei* and *Sphaerocoris annulus*, F., the Noctuid, *Egybolis vaillantina*, Stoll, and an unidentified Arctiid. A Pyralid, *Chilo* sp., did considerable damage to *Sorghum*, boring into the stem just below the head, which is later attacked and partly or wholly destroyed. After the crop is harvested (in May and June), the stems should be completely destroyed, instead of being left until November when they are burnt according to the native custom. This stem-borer also attacks maize. The Curculionid, *Cylas compressus*, Hartm., and a millepede did considerable damage to the sweet potato crop in the field.

From Iraq (Rustam), E. Guest reports (pp. 216–222) thrips attacking cotton and producing a leaf-curl early in the season, the young buds curling and withering before they are properly open. The most serious cotton pest was *Earias insulana*, which was probably present on local cotton and other malvaceous plants before the cultivation of American cotton (which is far more susceptible to attack) began. A. Dutt discovered that the larvae do not overwinter in cracks in the ground as they are reported to do in the Bombay Presidency, but a few survive in fallen bolls ; though most of these are probably killed by cold and shortage of food, a few emerge in February and subsist on various malvaceous plants until the cotton crop is sown. Multiplication from these few survivors is very rapid, the only checks being the dry heat of midsummer and parasites, one of which is *Microbracon brevicornis*, Wesm. (*kitcheneri*, D. & C.). Infestation reaches its height during the cool autumn weather before the crop is cut, and half the bolls may then show damage. A result of infestation is the introduction of the fungus, *Rhizopus nigricans*, which causes many blackened bolls towards the end of the season. The normal control measures are hand-collection and destruction of damaged shoots and buds containing larvae in the early part of the season. Ratoon cotton is a source of infestation, and a law has been passed forbidding ratooning, but this has not been strictly enforced in the past. After a season of particularly severe attack by this bollworm, dusting with equal parts of sodium fluosilicate powder and flour was tried with a hand duster, using about 8 lb. to each acre of cotton, and giving two applications, in September and November. The incidence of bollworms was considerably reduced, though the effect of dusting was not so great as might be expected. An Aleurodid, which is apparently similar to that attacking cotton in the Punjab and in the Sudan [*Bemisia gossypiperda*, Misra & Lamba], is often present on cotton in Iraq, particularly in country districts where cotton is generally unthinned and over-irrigated and is frequently over-shadowed by castor-oil plants [*Ricinus communis*]. Infestation causes premature opening of the

bolls and reduced quality of lint. Calm weather and high humidity encourage multiplication of the Aleurodid, which can best be checked by reducing the water supply to the crop. The annual depredations of the locust, *Dociostaurus maroccanus*, Thnb., largely prevent the extension of cotton-growing in northern Iraq. In the southern area, invasions of *Schistocerca gregaria*, Forsk. (*peregrina*, Ol.) occur periodically, but this locust is not endemic in Iraq and cannot as a rule withstand the climate. The greasy cutworm, *Agrotis ypsilon*, Hfn., attacks and destroys many young cotton seedlings about the middle of April; hand collection and destruction of the larvae are recommended.

Metalnikov (S.) & Metalnikov, jr. (S.). **Maladies des vers du coton** (*Gelechia gossypiella* **et** *Prodenia litura*).—*C. R. Acad. Agric. Fr.*, xviii, no. 6, pp. 203–207. Paris, 1932.

A study of *Platyedra* (*Gelechia*) *gossypiella*, Saund. (pink bollworm) and *Prodenia litura*, F., on cotton in Egypt showed that both are very susceptible to the attacks of various diseases. Larvae of the former often become heavily infected during the autumn, and by December about 99 per cent. may be destroyed. From dead or dying larvae the authors recovered two forms of *Bacterium gelechiae* (nos. 1 and 2), both of which produced death within 24–48 hours, and *B. rubrum*, which was also very virulent. From *P. litura*, of which the numbers were rapidly reduced by bacterial disease from the month of July onwards, 20 different micro-organisms were recovered, all of which, except *B. prodeniae*, which was the only one proved to be virulent, were asporogenous. The four named forms of *Bacterium*, which are readily cultured, are briefly described All these diseases appear only after the greatest damage has already been done by the larvae, and it is suggested that if they could be propagated early in the season they would prove of great value in checking, if not eliminating, injury by the pests in question. *Earias insulana*, Boisd., which frequently is also a serious pest, was very scarce while these studies were being made.

Akerman (C.). **On the carnivorous Habits of the long-horned Grasshopper,** *Clonia vittata* **Thunberg.**—*Ann. Natal Mus.*, vii, no. 1, pp. 143–144. London, February 1932.

The predacious grasshopper, *Clonia vittata*, Thunb., occurs in Natal in the long grass and weeds at the edge of maize fields, and its chief food is the larvae, pupae and adults of *Busseola fusca*, Fuller (maize stalk borer).

Newman (L. J.). **The principal Insect Pests of Tobacco.**—*J. Dept. Agric. W. Aust.*, (2) viii, no. 4, pp. 520–541, 21 figs., 1 diag. Perth, W.A., December 1931.

A somewhat popular account is given of the bionomics and control of the principal insect pests of tobacco in Western Australia. Clean cultivation, and especially crop rotation, will aid considerably in holding these insects in check. Against *Heliothis* (*Chloridea*) *obsoleta*, F., a spray of 1½–2 lb. lead arsenate to 100 gals. water, or a dust of 25 lb. to 75 lb. slaked lime, applied every 10–12 days up to the time of topping, will destroy the young larvae before they can do serious damage. If the buds or growing tips are attacked, a bait of 1 lb. lead

arsenate to 25 lb. pollard, applied at weekly or fortnightly intervals to the tips of the plant, is recommended. To avoid scorching, only a very small amount should be applied to each bud. For treatment of plants after the topping stage a contact spray should be used. These measures can also be employed against *Phytometra* (*Plusia*) *argentifera*, Gn., and other leaf-eating caterpillars. *Euxoa radians*, Gn. (*Agrotis munda*, Wlk.), the larvae of which attack the plants at night and hide in the soil during the day, may be held in check by a poison bait made by mixing 40 lb. bran and 1 lb. Paris green or sodium arsenate and adding 3 lb. molasses or treacle dissolved in water the whole being made up into a crumbling mash. The bait should be scattered along the rows of the plants, as late in the evening as possible, care being taken not to place it immediately against the stems. Sodium fluoride at the rate of 1 lb. to 30 lb. bran is also effective. Since the larvae of *Phthorimaea operculella*, Zell., do not spend the whole of their feeding period in one leaf or stem, but emerge and enter fresh ones, they can be killed by keeping the plants coated with lead arsenate applied as a dust or spray as recommended against *H. obsoleta*.

Control measures against the Pentatomid, *Nezara viridula*, L., include handpicking the eggs, which are laid in clusters on the leaves, and the use of soap or other contact sprays preferably before the insects have reached the adult stage. Similar sprays may be used for the control of *Nysius vinitor*, Bergr., against which various nicotine sprays or an emulsion of 8 tablespoons turpentine, 8 oz. soap and 4 gals. water, applied hot, are also recommended. Smudge fires are sometimes used against this bug as a means of driving a winged swarm out of a crop. The measures suggested against the Curculionid, *Listroderes praemorsa*, Lea, include the poison bait employed against *Euxoa*, a spray of 1 lb. lead arsenate to 32 gals. water, or a dust of equal parts of lead arsenate and lime. When seed-beds are attacked a lead arsenate spray or a dust of 1 lb. lead arsenate and 25 lb. pollard should be used. The usual measures against grasshoppers are suggested for the control of *Chortoicetes terminifera*, Wlk. Against *Halotydaeus destructor*, Tuck., nicotine sulphate and soap may be used for spraying or for immersing seedlings before planting out. Kerosene emulsion and other insecticides are also recommended. A band of creosote round the seed-beds prevents the mites from migrating to them from outside.

KUWAYAMA (S.). **Insect Pests of Hokkaido and their Peculiarity.** [*In Japanese.*]—*Yezo-Orai*, i, no. 1, pp. 16–19. Sapporo, 1931.

The insect fauna of Hokkaido is somewhat different from that of the mainland of Honshu, and the pests include certain species not found in Honshu, their biology also being different. *Aporia crataegi adherbal*, Fruhs., on apple and the Trichopteron, *Setodes argentata*, Mats., on rice, etc., are peculiar to Hokkaido, but *Lepidosaphes ulmi*, L., and *Eriosoma lanigerum*, Hausm., which were imported about 60 years ago, the former from Germany and the latter from Honshu, and *Bruchus pisorum*, L., and *Cydia* (*Laspeyresia*) *molesta*, Busck, which have recently been imported from Honshu and are now spreading, are found both in Hokkaido and Saghalin. The Trichopteron, *Oecetis nigropunctatus*, Ul., which occurs in Hokkaido, but not in Honshu and Korea, and *Parnara guttata*, Brem., both attack rice, the latter scarcely at all in Hokkaido but severely in Honshu. *Phenacoccus pergandei*, Ckll., which is known as a pest of mulberry on the mainland, attacks apple in Hokkaido.

Jarvis (E.). **Introduction of Wasp Parasites of Cane Grubs from Philippine Islands.**—*Queensland Agric. J.*, xxxvii, pt. 1, p. 18. Brisbane, 1st January 1932.

The Scoliid, *Campsomeris aureicollis*, Lep., recently introduced from the Philippines [*R.A.E.*, A, xx, 186], readily attacks not only the grey back cockchafer [*Lepidoderma albohirtum*, Waterh.] but also two other cane grubs, *Lepidiota frenchi*, Blkb., and *L. consobrina*, Gir. It completes its life-cycle in about the same time (42 days) as *C. tasmaniensis*, Sauss., a native species. The first brood of *C. aureicollis* was reared in January 1931, and since then two other broods have been propagated with a view to accumulating a stock for liberation purposes.

Ishii (T.). **On the natural Enemies of** *Prontaspis yanonensis*, **Kuw.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iii, no. 5, pp. 295–300. Tokyo, December 1931.

Prontaspis yanonensis, Kuw., which was originally imported from China, is very injurious to *Citrus* in Japan, and it is suggested that attempts should be made to introduce natural enemies of it from that country. A list, with biological notes, is given of insects attacking this Coccid in Japan. Of these, the most important is the Coccinellid, *Chilocorus kuwanae*, Silv., which has three generations a year near Nagasaki, but only two near Tokyo. It feeds on various Coccids, and one adult may eat from 1 to 17 adult female scale-insects a day, with an average of three. It is attacked by the lacewing, *Homalotylus flaminius*, Dalm., 51 per cent. being sometimes killed. *H. flaminius* is itself parasitised in the larval stage by a Ceraphronid, *Lygocerus* sp. *Scymnus* sp., which also feeds on *P. yanonensis*, but which is not of great importance, hibernates in the adult stage. It has possibly three generations a year and is parasitised by the Encyrtid, *Anisotylus albifrons*, Ishii. *Platynaspis nigra*, Wse., also feeds on the scale, and *Cybocephalus* spp. attacks it both in the larval and adult stages. A further enemy, *Chrysopa*, is killed by the Encyrtid, *Isodromus axillaris*, Timb.

Kato (M.) & Suganuma (Y.). **On the injurious Cicada,** *Cryptotympana coreanus* **Kato.** [*In Japanese.*]—*Kontyû*, v, no. 4, pp. 167–173, 1 pl. Tokyo, December 1931.

Descriptions are given of the adult and larva of the Cicadid, *Cryptotympana coreanus*, Kato, which is very common in Korea, the adults appearing in July and August and ovipositing in the young branches of poplar and various fruit trees, including apple, peach, pear, persimmon, mulberry, damson and chestnut.

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Paillot (A.) **Les variations du parasitisme bactérien normal chez le** *Chaitophorus* [*Periphyllus*] *lyropictus* **Kessl.**—*C. R. Acad. Sci. Fr.*, cxciv, no. 1, pp. 135–137, 2 figs., 1 ref. Paris, 1932.

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Hall (W. J.). **Some Aphidae of Southern Rhodesia with Descriptions of five apparently new Species.**—*Stylops*, i, pt. 3, pp. 49–61, 5 figs. London, 15th March 1932.

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Priesner (H.). **Ein neuer Blasenfuss, der Gallen an** *Euphorbia hirta* **verursacht.** [A new Thrips, *Haplothrips euphorbiae*, sp. n., producing Galls on the Leaves of *E. hirta* in Sumatra.]—*Misc. zool. sumatrana*, lviii, 4 pp., 2 figs., 1 pl. Medan, November 1931.

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Crosby (C. R.), Mills (W. D.) & Blauvelt (W. E.). **Protecting Orchard Crops from Diseases and Insects.**—*Bull. Cornell Univ. Agric. Expt. Sta.*, no. 498 (revd.), 78 pp., 18 figs. Ithaca, N.Y., December 1931. [*Cf. R.A.E.*, A, xviii, 279.]

LEEFMANS (S.). **De thans bekende ziekten en plagen van orchideeën in Nederlandsch-Indië en hare bestrijding.** [Diseases and Pests hitherto recorded from Orchids in the Netherlands Indies and their Control.]—24 pp., 12 figs., 8 refs. Bandoeng, N.V. Mij. Vorkink, 1931.

Insects attacking orchids in the Netherlands Indies include the Capsid, *Mertila malayensis*, Dist. [*cf. R.A.E.*, A, vii, 39], against which a spray of derris and soap has given good results, and the Lycaenid, *Chliaria orthona dendrobii*, Roepke [*cf.* viii, 40], which has been recorded from Sumatra and Nias as *C. rora*, Kheil. Roepke advised the collection of the adults and eggs. The Hispids, *Oncocephala angulata*, Gestro, and *Gonophora xanthomelaena*, Wied. (of which *Agonia spathoglottis*, Uhmann, is probably a synonym) mine the leaves; the adults should be collected or the leaves sprayed with a mixture of 2 per cent. lead arsenate and 3 per mille soap. Another Hispid, *Callispa duodecimmaculata*, Chap., oviposits in a cavity eaten out of the leaf of *Spathoglottis plicata*, to which orchid it appears to be restricted. The egg, larval and pupal stages last 9–11, 18–19 and 9–10 days. The larvae feed in the partly unfolded young heart leaves and at the bases of the older leaves, and may be controlled by dusting the heart with a mixture of 3 parts fine wood-ashes and 1 part pyrethrum or spraying with 2 per cent. lead arsenate. A species of *Crioceris*, probably *C. subpolita*, Motsch., oviposits on the flowers and flower-stalks of various orchids. The larva hatches in 4–5 days and feeds on the flowers for 9–10, after which it passes an inactive stage lasting 4–6 days in a covering of froth. The pupal stage occupies 6–7 days, and the adult remains for 2–3 days in the pupal case. Collection of both adults and larvae is easy. The Curculionid, *Omobaris calanthes*, Mshl., occurs in *Calanthe* spp. and *Phajus tankervilliae*. The adults make holes in the heart-leaves, and the larvae mine the growing point. Spraying with 2 per cent. lead arsenate is an effective measure and will also control the grasshopper, *Valanga nigricornis*, Burm., which attacks *Vanda teres* in dry weather. The caterpillars of *Notolophus* (*Orgyia*) *posticus*, Wlk., and of *Creatonotus* sometimes feed on the flowers and aerial roots of orchids.

SCHEDL (K. E.). **Parasites reared from Forest Insects in 1929.** —*Canad. Ent.*, lxiv, no. 1, pp. 1–2. Orillia, Ont., January 1932.

The parasites recorded are: *Cheiropachys obscuripes*, Brues, *C. colon*, L., *Spathius canadensis*, Ashm., *Brachistes* sp., *Eurytoma crassineura*, Ashm., and a variety of this species from *Scolytus rugulosus*, Ratz., in apple, and *C. colon*, *Cinetus canadensis*, Ashm., *Spathius tomici*, Ashm., *Eurytoma* sp. and three species of *Habrocytus* from *Phloeosinus canadensis*, Sw., in *Thuja occidentalis*, all in Ontario; *Nemorilla maculosa*, Mg., *Pimpla* (*Itoplectis*) *leavitti*, Cush., *P.* (*I.*) *conquisitor*, Say, *P.* (*Apechthis*) *ontario*, Cress., *P.* (*Epiurus*) sp., *P.* (*E.*) *indigatrix*, Cress., *Phaeogenes gaspesianus*, Prov., *P. hariolus*, Cress., *Meteorus trachynotus*, Vier., *Gelis* sp. and *Ascogaster* sp. (near *provancheri*, D.T.) from pupae of *Peronea variana*, Fern., in Nova Scotia; and *P.* (*I.*) *montana*, Cush., *Mastrus neodiprioni*, Vier., *Mesochorus basalis*, Cress., *Gelis* sp. and *Hyposoter* sp. from *Ellopia fiscellaria*, Gn., in British Columbia.

In addition, the following insects were found in the tunnels of wood-boring Coleoptera in Ontario; the Pythid, *Salpingus virescens*, Lec.,

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in association with *Scolytus rugulosus* ; the Cucujid, *Silvanus bidentatus*, F., with *Phloeosinus canadensis* ; the Histerids, *Cylistix cylindrica*, Payk., and *Platysoma coarctatum*, Lec., and the Staphylinid, *Nudobius cephalus*, Say, with *Ips pini*, Say, in *Pinus sylvestris* ; and *N. cephalus* and the Tenebrionid, *Hypophloeus parallelus*, Melsh., with *I. perroti*, Sw., in Jack pine [*Pinus banksiana*].

DEL CAÑIZO (J.). **La " chinche " de la remolacha** (*Cassida vittata*, **Villers).** [The Sugar-beet Beetle, *C. vittata*.]—*Bol. Pat. veg. Ent. agríc.*, v (1930), no. 19–22, pp. 1–13, 6 figs., 11 refs. Madrid, December 1931.

Since it was first recorded in Spain in 1898, *Cassida vittata*, Villers, has become an important pest of sugar-beet in Granada and Almeria, serious outbreaks occurring in 1907–8 and in 1930. A brief description is given of the larva, pupa, and adult ; both adults and larvae feed on the foliage. The beetles, which hibernate among rushes on the edges of irrigation channels and among chenopodiaceous weeds, appear in the fields at the end of March and oviposit during a period of about a fortnight. The larvae hatch in about 8 days, and by the end of April the injury they do is already noticeable. Adults of the first generation appear in early May, and those of the second about mid-June. The beetles disappear from beet fields at the end of June, but have been observed on various chenopodiaceous weeds, such as *Atriplex*, at the end of summer. There does not seem to be a third generation in Spain, possibly because of the extreme heat and drought. No insect enemies have been observed. Spraying with lead arsenate proved very successful, and dusting with calcium arsenate and collection of the adults are also recommended. In winter the various plants affording shelter should be destroyed.

Cassida nebulosa, L., does not occur in Spain, and *C. deflorata*, Suffr., which is a pest of artichokes [*Cynara*] there, does not attack beet.

BENLLOCH (M.) & JIMÉNEZ CUENDE (F.). **La invasión filoxérica en España.** [The Spread of *Phylloxera* in Spain.]—*Bol. Pat. veg. Ent. agríc.*, v (1930), no. 19–22, pp. 14–37, 17 figs., 31 refs. Madrid, December 1931.

Phylloxera has spread in Spain since its introduction in 1878, and replanting vineyards with American stocks is now a general practice. This paper gives a brief account of the life-cycle of the pest and discusses the various ecological factors affecting its development, as recorded in the literature, with special reference to various districts in Spain.

GÓMEZ CLEMENTE (F.). **Las palomillas de la alfalfa.** [Lucerne Moths.]—*Bol. Pat. veg. Ent. agríc.*, v (1930), no. 19–22, pp. 47–58, 10 figs. Madrid, December 1931.

In Valencia, lucerne is severely injured in summer and autumn by *Loxostege sticticalis*, L., and the Tineid, *Nothris lotellus*, Const., which does not appear to be a pest elsewhere than in Spain. The first adults of *L. sticticalis*, which has 3–4 generations a year, appear about mid-June, and the larval and pupal stages each occupy about a fortnight. *N. lotellus*, which may have 6–7 generations from July to October,

appears about the end of June and deposits its eggs in batches on the leaves. The larvae feed on the tender portions of the nearest leaves and then migrate to the terminal ones, where they spin webs within which they feed. The pupal stage lasts 5–7 days in summer. When the lucerne is mown, the moths oviposit on the lower leaves of the cut stems or migrate to other plants on the borders of the field. Natural enemies include various birds and Hymenopterous parasites.

The measures used in other countries against *L. sticticalis* are briefly reviewed. *N. lotellus* is more difficult to control owing to its silken shelter. The best results obtained by the author were secured by removing the lucerne as soon as cut and dragging a bush-harrow over the field, the latter process being repeated 3 days later. This was followed by dusting with a mixture of 1 part lime-sulphur and 3 parts gypsum to prevent oviposition, and when the lucerne had grown to a height of 5–6 inches, it was again dusted. Finally a 1–1·25 per cent. spray of a calcium arsenate containing 30 per cent. arsenic anhydride was applied. The addition of 0·5 per cent. oil increases the toxicity of the spray and the amount of arsenate can be reduced. Other effective sprays contained 0·15 per cent. nicotine sulphate and 0·35 per cent. calcium arsenate, or 0·3 per cent. calcium arsenate, 0·25 per cent. lime-sulphur powder and 0·12 per cent. nicotine sulphate. These measures also control *L. sticticalis*.

Herce (P.). **Análisis químico de insecticidas cianurados.** [The Chemical Analysis of Cyanide Insecticides.]—*Bol. Pat. veg. Ent. agríc.*, v (1930), no. 19–22, pp. 86–91, 2 figs. Madrid, December 1931.

This paper describes Liebig's volumetric method of analysis, which is recommended as being the best for use in agricultural laboratories where it is desired to test the CN content of cyanide fumigants.

Quillis Pérez (M.). **La lucha biológica contra las malas hierbas.** [The biological Control of Weeds.]—*Bol. Pat. veg. Ent. agríc.*, v (1930), no. 19–22, pp. 92–99, 8 figs. Madrid, December 1931.

In the author's observations in Valencia on insects infesting weeds of the families Compositae and Euphorbiaceae, most of them developed so much later than the plants that they produced little effect, but they might be of some value if they could be bred in the laboratory and be ready for release on the first appearance of the latter.

Trabajos de las Estaciones de Fitopatología agrícola en el año 1930. [Work of the Stations of agricultural Phytopathology in Spain in 1930.]—*Bol. Pat. veg. Ent. agríc.*, v (1930), no. 19–22, pp. 137–195. Madrid, December 1931.

As in previous years [*R.A.E.*, A, xvii, 697; xix, 279], short notes are given on the pests and diseases observed in Spain in 1930 by the various phytopathological stations.

Sawa (R.). *Anomala rufocuprea*, **Motsch., in the Ibaragi Prefecture.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iii, no. 5, pp. 319–322. Tokyo, December 1931.

The larvae of *Anomala rufocuprea*, Motsch., feed on the roots of rice in the Ibaragi Prefecture from about 20th May onwards and often kill the plants. The adults also attack soy-beans.

Menozzi (C.). **Sui danni procurati alla barbabietola dagli insetti nella campagna saccarifera 1931.** [On the Damage caused by Insects to Sugar-beet in Italy during the year 1931.]—*L'Ind. saccarif. ital.*, xxiv, no. 12, reprint 7 pp., 3 figs. Genoa, December 1931.

Rain, snow and cold weather early in 1931 delayed the appearance of *Conorrhynchus* (*Cleonus*) *mendicus*, Gyll., in Italy, and it caused much less harm than in previous years [*R.A.E.*, A, xviii, 561 ; xix, 461]. The measures hitherto used for its control proved satisfactory. Against *Cassida vittata*, Villers, a lead arsenate spray is effective when the beet plants are young ; later on, dusting with calcium arsenate is the best measure. On the whole *C. vittata* did not do much harm, the larvae and pupae being destroyed in many parts of central Italy by a fungus. *C. nobilis*, L., which as in 1930 occurred in the lower valley of the Po, was very abundant until about July when *Tetrastichus bruzzonis*, Masi, destroyed large numbers, the rate of parasitism being as high as 56 per cent. Repeated attempts to establish *T. bruzzonis* in central Italy against *C. vittata* were unsuccessful, and the author doubts whether it can parasitise this host. He suggests that the original records from *C. vitatta*, which were made from north-eastern Italy [xviii, 367, 562] where he has only found *C. nobilis* to occur, may have been due to misidentification. In experiments against the Halticid, *Chaetocnema tibialis*, Illig., only the adults of which attack beet, a solution containing 2 per cent. soft soap and 7½ per mille caustic soda killed some of the beetles. It seems possible to use a stronger solution without injuring the beet plants, and if this could be applied when the last generation of the pest is entirely or almost entirely on beet, most of the beetles would be destroyed. In a search for the plants on which the eggs are laid and the larvae develop, the leaves of *Plantago major* were found to be attacked by *C. tibialis* and a less common Halticid, *Longitarsus pellicidus* Foudr., and the roots were infested by unidentified Halticid larvae. The beet-fly, *Pegomyia hyoscyami*, Panz., again caused considerable loss in north Italy. It was associated with *P. esuriens*, Mg., and the Ephydrid, *Clanoneurum menozzii*, Séguy. Spraying with nicotine sulphate proved effective against these flies. *Gryllus desertus*, Pall., *Lixus junci*, Boh., and *L. scabricollis*, Boh., were recorded on beet from various localities, and *Phthorimaea ocellatella*, Boisd., was observed throughout the beet areas of central and northern Italy, but did little harm as it only occurred at harvest time.

Russo (G.). **Contributo alla conoscenza degli Scolytidi. II. Lo Scolitide del mandorlo : *Scolytus amygdali* (Guèr.). Note biologiche.** [A Contribution to the Knowledge of Scolytids. II. The Almond Scolytid, *S. amygdali*, Guér.]—*Boll. Lab. Zool. Portici*, xxv, pp. 327–349, 6 figs. Portici, 1931.

This is a preliminary account of observations on the bionomics of *Scolytus amygdali*, Guér., on almond, made in the laboratory at Portici and in the field near Catania, Sicily. Adults occur more or less continuously from April to September, those of the summer generation usually beginning to emerge from the branches in the latter month. Their progeny generally hibernate as mature larvae, pupating in the following spring, but if conditions are very favourable, they may appear as young adults in October.

Some of the young adults bore into shoots and small twigs in order to feed before breeding elsewhere, whereas others migrate to branches suitable for breeding and begin reproduction, without first feeding. Feeding occurs in normal trees, but breeding takes place in unhealthy trunks or branches, which are killed. A detailed account is given of mating and of the brood galleries.

Neither heat nor cold affects *S. amygdali*, but rain may encourage fungous or bacterial diseases of the larvae. In Sicily the larvae are preyed upon by the mite, *Pediculoides ventricosus*, Newp., and the Cucujid, *Laemophloeus perrisi*, Grouv. The most common parasites are Chalcidoids, which in order of abundance are *Cheiropachys colon*, L., *Eurytoma masii*, Russo, *Rhaphitelus maculatus*, Wlk., *Cerocephala cornigera*, Westw., and *Eupelmus urozonus*, Dalm. Other parasites include a Braconid, *Ecphylus* sp., which is fairly common, and a Bethylid, possibly a species of *Sclerodermus*. For control, infested material and all withered or withering twigs and branches should be destroyed, and branches attractive to the beetle placed in the trees as traps. The trunks and larger branches may be limewashed, but trees weakened by drought are best cut down to the ground. Indirect measures include the removal of bark from almond branches used for fencing, the selection of suitable soil for planting the trees and adequate manuring.

Goetze (G.) & Schleusener (W.). **Versuche zur Bekämpfung der Weidenblattkäfer.** [Experiments in Combating the Willow Beetle.]—*Z. PflKrankh.*, xlii, no. 2, pp. 49–58, 2 refs. Stuttgart, February 1932.

This is a detailed report on a series of experiments made to ascertain the best method of controlling *Phyllodecta vulgatissima*, L., which is a serious pest of basket willows in Germany [*R.A.E.*, A, xvi, 56] and appeared in large numbers in the spring of 1931 near Gurkow (Brandenburg). As a result, a spray containing 0·5 per cent. sodium fluoride and 2 per cent. sugar is recommended. The chief application should be made in mid-July against the summer generation, but it is likely that repeated spraying in spring during the flight-period may also be of practical value. *Plagiodera versicolor*, Laich., which occurred in the same locality on American willows, is apparently also controlled by this spray.

Kirschner (R.). **Beiträge zur Biologie von *Phorodon humuli* Schrk. nebst Bemerkungen und Versuchen über das Entstehen von geflügelten Aphiden. (I. Beitrag.)** [Contributions to the Biology of *P. humuli*, with Observations and Investigations on the Origin of winged Aphids.]—*Biol. Zbl.*, lii, no. 2, pp. 103–117, 28 refs. Leipzig, 1932.

In 1925 a winged generation of *Phorodon humuli*, Schr., appeared on hops in Saxony at the beginning of July. This generation had not migrated from winter quarters on *Prunus* or *Rosa*, but developed on the hop itself. This deviation from the normal life-cycle was found to be due to chemical change in the food-plant caused by leaf-roll disease. The development of winged forms in Aphids may also be influenced by starvation, light and ultra-violet rays. Starvation experiments carried out by the author with a tulip Aphid caused only a slight increase in

the percentage of winged forms. Constant illumination checked wing-formation. Ultra-violet rays, followed by normal conditions, gave a 10 per cent. increase of winged forms, while ultra-violet rays followed by constant illumination, instead of lessening the percentage, resulted in 28 per cent. of winged progeny.

ABEL (H.). **Massenvorkommen von Heimchen auf einem Müllabladeplatz und deren Bekämpfung.** [A Mass Occurrence of Crickets in a Refuse Dump and its Control.]—*Der prakt. Desinfektor*, xxiv, no. 1, pp. 9–12. Dresden, January 1932.

A mass occurrence of *Gryllus domesticus*, L., in a rubbish dump near Frankfort-on-Main was controlled by turning over the material to a depth of 2 ft., and at the same time spraying the crickets thus disturbed with an emulsion containing 15 per cent. kerosene and 2 per cent. soft soap. The crickets that had entered houses 50–100 yards away were subsequently killed by dusting their hiding places with a proprietary insecticide.

METCALF (C. L.) & FLINT (W. P.). **Fundamentals of Insect Life.**—Demy 8vo, xi+581 pp., 315 figs. New York & London, McGraw-Hill Pub. Co., Ltd., 1932. Price 30*s.* net.

This book is supplementary to the authors' previous work, "Destructive and Useful Insects" [*R.A.E.*, A, xvii, 29], but stresses the biological rather than the agricultural point of view. The first ten chapters have been revised and much new material added, particularly in the case of the one describing the more important orders and families of insects, which has been entirely re-written, and those dealing with insect control and apparatus for applying insecticides. Three new chapters discussing biological and ecological phenomena are appended.

CHAPMAN (R. N.). **Animal Ecology with especial Reference to Insects.**—Demy 8vo, x+464 pp., 137+16 figs., num. refs. New York & London, McGraw-Hill Pub. Co., Ltd., 1931. Price 24*s.* net.

This volume is based on lectures already noticed when issued in mimeograph form [*R.A.E.*, A, xv, 547], but which have since been constantly revised and amplified. The rapid appearance of the results of new research has made it difficult to keep the work of revision up to date, but as now presented it should prove very useful to students and workers on the subject. A valuable feature is the extensive bibliography accompanying each section, and in an appendix by Professor V. Volterra an attempt is made to show by means of mathematical formulae the variations and fluctuations in the numbers of individuals in animal species living together.

COPELAND (E. B.). **The Coconut.**—Demy 8vo, xviii+233 pp., 22 pls., 2 figs. London, MacMillan & Co., Ltd., 3rd edn., 1931. Price 20*s.* net.

This is a revised edition of a work that has already been reviewed at length [*R.A.E.*, A, iv, 148–151], the bulk of the additional information on insects contained in it having also been noticed from other sources. Insects doing minor injury to coconut in Java include the Hispid, *Botryonopa sanguinea*, Guér. *Psyche albipes*, Moore, attacks coconuts in

Ceylon, and *Heliothrips haemorrhoidalis*, Bch., has been reported as a minor pest in Trinidad. The application of a tarred band or tin collar to the trunks of trees threatened with infestation is recommended against *Graeffea cocophaga*, Newp., which occurs from New South Wales northwards and eastwards across Polynesia, and *Hermarchus pythonius*, West. The eggs of these Phasmids hatch on the ground, and the young climb the trees.

Edwards (E. E.). **Cabbage Root Fly and Methods for its Control.**—*J. Minist. Agric.*, xxxviii, no. 12, pp. 1230–1237, 2 pls., 6 refs. London, March 1932.

During 1931, trials were made of the effectiveness of mercury bichloride, naphthalene and tarred felt disks against the cabbage root fly [*Phorbia brassicae*, Bch.] on cauliflower in England. The results of the tests confirmed previous findings of the relative value of these treatments [*R.A.E.*, A, xvi, 280; xix, 74, 322, etc.]. The highest increase, which averaged 54 per cent., in the number of unattacked or marketable plants was found in the plots treated with mercury bichloride (1 oz. to 8 gals. water), three treatments of which were given at intervals of about 10 days, starting 4 days after planting out, ¼ pint being applied to the soil around the base of each plant. In the plots treated with naphthalene, tarred felt disks and alum (which was applied in the same way as mercury bichloride, using 2 oz. to 1 gal. water), the increases averaged 36, 40 and 10 per cent., respectively, over the untreated plots. In three of the four tests with alum the treatment gave little or no increase. None of the treatments had any harmful effect on the plants, except on one occasion when naphthalene was applied on a dry, windy day, so that it collected on the foliage and stems and caused scorching. With the disks, much difficulty was experienced in keeping them flat and their surfaces free from soil; as they required constant attention for the first five weeks, they are not considered practical or economical. Although mercury bichloride has undoubtedly been used with great success, it is a dangerous poison and entails the usual difficulties in dealing with a liquid. As naphthalene is easily handled and can be stored in air-tight containers, it seems that its use would offer the simplest solution of the problem of controlling *P. brassicae*. The grade of naphthalene employed was "drained creosote salts," about 1 oz. of this powder being applied by hand to the soil round the plants. Three applications were made at intervals of 7–10 days, beginning immediately after planting out in order to prevent the fly from ovipositing.

Adkin (R.). *Borkhausenia pseudospretella* **Stt. attacking Book-bindings.**—*Ent. Mon. Mag.*, lxviii, no. 813, pp. 40–41.

Haines (F. H.). *Borkhausenia pseudospretella* **Stt. attacking Book-bindings.**—*T.c.*, no. 814, p. 68.

Laing (F.). *Borkhausenia pseudospretella* **and other House Moths.**—*T.c.*, no. 815, pp. 77–80. London, February-April 1932.

Two further instances, observed ten or more years ago, are recorded of *Borkhausenia pseudospretella*, Staint., attacking leather book-bindings in Britain [*cf. R.A.E.*, A, xx, 118]. In the second paper it is pointed out that bindings of cloth were never attacked. Dampness appears to favour the spread of every species of clothes moth, and books on the

lower shelves in damp libraries are particularly susceptible to attack.

In the third paper the habits of this moth are reviewed, and it is suggested that it is primarily a pest of vegetable materials, such as grain débris, stored hops, etc., but as a household pest has adapted itself to upholstery, carpets and cloth, whereas the true clothes moths feed primarily on materials of animal origin, such as wool, fur and feathers, and have become adapted to vegetable materials. It is possible that in both cases the development of secondary habits is due to the method of manufacture of textiles, but further information is required on this point, The life-history of *Borkhausenia* differs from those of *Tineola biselliella*, Humm., and *Tinea pellionella*, L., in that it averages 11–13 months, the adults emerge at any time of the year and the larvae continue to feed throughout the winter.

Trichophaga tapetzella, L., and *Endrosis lacteella*, Schiff., have been stated to be common in houses ; the author has found the former feeding on the fur of old rabbit skins out of doors and on old stable rugs ; the larvae of the latter have been reported as attacking carpets in a house infected with dry rot.

Balachowsky (A.). **Sur la présence du pou de S. José (*Aonidiella perniciosa*, Comst.) sur les pommes de provenance américaine vendues sur le marché de Paris.**—*Bull. Soc. ent. Fr.*, xxxvii, no. 2, pp. 34–35. Paris, 1932.

The author has found *Aspidiotus* (*Aonidiella*) *perniciosus*, Comst. (San José scale) on apples from the United States bought in Paris, and it has also been intercepted on apples from New Zealand. The danger of the establishment of this insect, which does not occur in Europe, is evident ; it would be sufficient to start an outbreak for an apple peeling to be thrown down in a favourable spot.

Lataste (F.). **Addition à ma note du 10 mars 1931 sur le criocère du lis.**—*Bull. Soc. zool. Fr.*, lvii, no. 1, pp. 36–39, 1 ref. Paris, 15th March 1932.

Further details [*cf. R.A.E.*, A, xix, 567] of the biology in France of the lily beetle [*Lilioceris* (*Crioceris*) *lilii*, Scop.] are given. In captivity a female began to oviposit on 21st March and continued daily for 34 days, laying between 200 and 300 eggs. Some hatched on the seventh day after oviposition. Large numbers of the beetles were observed in the garden from 18th March, the first eggs being found on 26th May. As a result of parasitism by Hymenoptera, no eggs, larvae or adults were to be found after 20th June.

Pape (H.). **Die Praxis der Bekämpfung von Krankheiten und Schädlingen der Zierpflanzen.** [The Practice of Control of Diseases and Pests of Ornamental Plants.]—Med. 8vo, xi + 361 pp., 271 figs., 8 col. pls. Berlin, P. Parey, 1932. Price, bound, *M.*18.

This is a practical handbook intended for use in Germany. It opens with a general account of the diseases and insect and other pests that attack ornamental plants and the measures available against them. About 300 pages are devoted to the diseases and pests individually, those peculiar to given plants being dealt with under the heading of the plant concerned. A bibliography covering 4 pages, indices to the German and scientific names of the plants and a subject index are appended.

Laing (F.). **A new Aphid-pest of Violets.**—*Ent. Mon. Mag.*, lxviii, no. 814, pp. 52–53. London, March 1932.

Winged and wingless viviparous females of *Myzus ornatus*, sp. n., are described. The Aphids were found attacking a hairy-leaved variety of violet in Devon ; their feeding causes the margins of the leaves to roll upward and white spots, which subsequently turn green, to appear on the flower petals.

Liro (J. I.). **Ueber die Eriophyiden der** *Corylus* **Arten.** [On the Eriophyids infesting Species of *Corylus*.]—*Ann. Soc. zool.-bot. fenn. Vanamo*, xii, no. 3, pp. 47–90, 10 figs., 9 pp. refs. Helsingfors, 1931.

Descriptions, usually with Nalepa's figures, are given of the gall-mites found by the author on hazel (*Corylus avellana*) in Finland, *viz.*, *Eriophyes avellanae*, Nal., *E. vermiformis*, Nal., *Phyllocoptes coryli*, sp. n., *P. comatus*, Nal., *Oxypleurites depressus*, Nal., and *Anthocoptes loricatus*, Nal., together with a detailed discussion of the manner in which they infest it. They include all the species that have been recorded from hazel in other countries.

Heikertinger (F.). **Zur Phytophagie der** *Amara* (*Cyrtonotus*) *aulica* **Panz.**—*Koleopt. Rdsch.*, xvii, no. 6, pp. 246–247. Vienna, 31st January 1932.

Exact observations on phytophagous habits in Carabids are rare. In September 1931 in Austria the author found an adult of *Amara aulica*, Panz., feeding on the seeds in the fruits of the composite, *Leontodon danubialis*, and tests in captivity proved these to be a natural food of this Carabid.

Malenotti (E.). **Esche e raccolta di nidi contro le grillotalpe.** [Poison-baits and Collection of Nests against Mole-crickets.]—*Giorn. Agric. Domenica*, 1932, no. 4, p. 48, reprint 6 pp. Piacenza, 24th January 1932.

Various poison-baits that have been suggested against *Gryllotalpa gryllotalpa*, L., are reviewed, that of broken rice poisoned with zinc phosphide being considered the best. The method of waterproofing it with olive oil [*R.A.E.*, A, xx, 77] has been discarded on account of cost, increased danger to domestic animals and game owing to greater permanence, and the fact that after rain the bait becomes soiled with earth and inacceptable to the mole-crickets. Digging out the crickets and their eggs, a widely advocated measure, is also discussed but is considered not to be of practical value.

Malenotti (E.). **Grillotalpe morte e uccelli vivi.** [Mole-crickets dead and Birds alive.]—*Il Coltivatore e Giorn. vinic. ital.*, 1932, no. 6, reprint 6 pp., 1 fig. Casale Monferrato, 1932.

Experiments at Verona showed that barium fluosilicate is as effective as zinc phosphide as a poison-bait against *Gryllotalpa gryllotalpa*, L. [see preceding abstract]. The mole-crickets accept both poisons equally readily, and they are of the same toxicity. Barium fluosilicate was found to be harmless to poultry.

RAMBOUSEK (F.). **Výskyt červců na řepách.** [The Occurrence of Coccids on Beet.] [*In Czech.*]—*Ochr. Rost.*, xi, no. 5, pp. 150–153, 3 figs. Prague, November 1931.

Owing to the unusually mild autumn in 1929 in Czechoslovakia, many species of insects produced an additional generation ; larvae of the beet-fly, *Pegomyia hyoscyami* var. *betae*, Curt., for example, were present in the field as late as the end of October. About the middle of the month larvae of the plum scale, *Lecanium corni*, Bch., were found causing injury to the lower surface of the leaf-stems of beet near Prague, and larvae collected in the field and placed on the stems of healthy beet plants infested them in a similar manner. It is not considered probable that the Coccids were carried by wind with fallen leaves from trees in the vicinity, as the infestation was evenly distributed throughout the beet fields, 1–3 larvae occurring on each of the central leaves of the plants, and a careful examination of the trees showed that they were free from scales, with the exception of some plums on which a few females, but no larvae, were present.

RAMBOUSEK (F.). **Letošní stav řepních škůdců (na jaře 1931).** [Pests of Beet in the current Year (in the Summer of 1931).] [*In Czech.*] —*Ochr. Rost.*, xi, no. 5, pp. 153–158. Prague, November 1931.

Following the dry and moderately cold winter of 1930–31 in Czechoslovakia, which was very favourable to the hibernation of various species of insects, an outbreak of the Cryptophagid, *Atomaria linearis*, Steph., occurred on beet throughout the country in April. In a number of fields the beetles destroyed all the plants in the soil before they appeared above the surface, the damage caused being often erroneously attributed to wireworms. Later, the more advanced plants were injured at the root collar ; those that had already developed four leaves, however, resisted the infestation. Careful examination of the fields and removal of the infested plants is recommended, but beet should not be thinned too early, otherwise various pests appearing later will congregate on the remaining plants and may destroy the whole crop. Other pests present in numbers in various districts were *Otiorrhynchus ligustici*, L., and *Tanymecus palliatus*, F., which was found in plantations adjoining clover fields. The beet-fly [*Pegomyia hyoscyami* var. *betae*, Curt.] was successfully controlled with 0·5 per cent. sprays of sodium fluoride applied in large drops, which the flies drink. In some places beet was attacked by black Aphids, which migrated from heavily infested maple trees in the vicinity.

RAMBOUSEK (F.) & NEUWIRTH (F.). **Příspěvek k epidemologii mouchy burákové.** [Contribution to the Epidemiology of the Beet-fly.] [*In Czech.*]—*Ochr. Rost.*, xi, no. 5, pp. 158–167. Prague, November 1931.

The effect of climate and weather on the rate of development of insects and the number of generations produced is discussed, to show the importance of studying the conditions governing general and local outbreaks of pests in order to be able to predict them and apply suitable control measures. Notes are given on the bionomics of the beet-fly [*Pegomyia hyoscyami* var. *betae*, Curt.] as observed in various parts of Czechoslovakia in the course of the last seven years. The flies that emerge from overwintered pupae are on the wing at the time of the

flowering of sloe and cherry, and a second flight often takes place somewhat later, consisting of adults that have developed from eggs laid in the preceding October if the autumn was warm. A female lays on an average 20 eggs, in batches of 3–12, on the lower surface of the leaves, the healthy and more developed ones being invariably chosen ; in two adjoining fields beet sown late escaped injury, whereas that sown early was severely infested. By thinning the plants after oviposition is over, at least 90 per cent. of the eggs may be destroyed ; the uprooted plants should be removed from the field before becoming dry. Some of the eggs may be washed away by rain and embedded in the soil, and in dry weather some fail to hatch.

The value of the egg parasite, *Trichogramma evanescens*, Westw., is reduced by the fact that it is polyphagous ; though this facilitates the breeding of the parasites in the laboratory, when liberated in an infested field, they do not concentrate on eggs of *Pegomyia* alone. Moreover, several females frequently oviposit in a single host egg. At temperatures above 35°C. [95°F.], the eggs of *Trichogramma* do not hatch. Parasites of the larvae are *Opius nitidulator*, Nees, and *Apanteles congestus*, Nees, which may completely control an outbreak [*R.A.E.*, A, xix, 590], and the Tachinid, *Melanophora roralis*, L. (*atra*, R.-D.), which is rare, and both larvae and adults are preyed upon by an Asilid. The relation between the occurrence of *P. hyoscyami* and the annual isotherms of the beet-growing regions is briefly discussed from the literature [xvii, 599] ; in Czechoslovakia as many as 7 generations are sometimes produced in a hot season. Summer temperature has, however, a much greater effect on the development of the parasites of the fly, so that a cool summer favours the latter. The possibility of forecasting the severity of infestation in the following year by investigating the rate of parasitism of the hibernating pupae in the autumn is pointed out, and the value in this connection of mobile field stations is briefly discussed.

[Vukasović (P.).] **Вукасовић (П.). Contribution to the Study of Insect Associations.** [*In Serbian.*]—*Spomenik*, lxx, prvi Razr. [First Series] 16, pp. 35–91, 26 figs., 16 graphs, 3 refs. Belgrade, 1931.

The author briefly discusses the importance of the employment of parasites in the biological control of insect pests, and the lack of detailed study with regard to the use of indigenous species and the relations between them and their hosts. He gives a full account of his investigations in various parts of Serbia during 1925–26, 1928 and 1930 on the parasites and hyperparasites of *Hyponomeuta malinellus*, Zell., on apple. The biology of this moth is discussed at length from the literature and his own observations [*cf. R.A.E.*, A, xv, 415 ; xix, 288]. The young larvae usually appeared in the beginning of April and sometimes earlier, and the adults, the emergence of which largely depends on the temperature, were on the wing in the first half or about the middle of June. In the insectary the males lived for an average of 22·5 days, with a maximum of 43, and the females for 33·5, with a maximum of 46. Excessive heat or moisture were injurious to the moths ; in the field, favourable conditions for an increase of infestation are afforded by a dry summer following a rainy year, when the moisture still present in the soil and trees moderates the heat. The females were decidedly attracted to apple for oviposition.

A list is given of the parasites and hyperparasites recorded in the literature, as well as a list of the species observed by the author in Serbia, which include, besides those already noticed [xv, 124, 387], the Tachinid, *Ptychomyia selecta*, Mg., three hyperparasites, *viz.*, the Ichneumonid, *Hemiteles scabriculus*, Thoms. (which is recorded for the first time as a parasite of the larvae of *Angitia armillata*, Grav.), and the Chalcidoids, *Monodontomerus aereus*, Wlk., and *Elasmus flabellatus*, Boy. (which is a parasite of the larvae and pupae of *A. armillata* and *Mesochorus confusus*, Hlmgr.). Brief notes on the biology of most of the parasites are given, and the female genitalia of *Herpestomus brunnicornis*, Grav., *A. armillata*, *Tetrastichus crassinervis*, Thoms., *Discochaeta yponomeutae*, Rond. (*cognata*, Schin.) and *E. flabellatus* are described. Most of the parasites of *H. malinellus* observed in Serbia were rare and, with the exception of *D. yponomeutae*, which alone was numerous, and of *A. armillata* and *T. crassinervis*, are probably accidental.

A large section of the paper deals with the estimation of the activity of the parasites and hyperparasites, based on the examination of nests of *Hyponomeuta* from different localities and in different years. On an average the total rate of parasitism is not more than 30 per cent. This may be explained by the fact that the larvae of the host, which has only one generation a year, appear early in the spring when the parasites are comparatively scarce, and the moths emerge in June, so that later in the season most of the recorded parasites are compelled to attack other hosts. Moreover, the combined action of the hyperparasites is more marked than that of the parasites. It was found that *T. crassinervis* not only attacked *Hyponomeuta* and some of its Hymenopterous parasites [xv, 125] but also the pupae of *D. yponomeutae*.

It is suggested that the effectiveness of the indigenous parasites of *H. malinellus* could only be increased by attracting the polyphagous species to infested districts. This could be done by cultivating the food-plants of the alternative hosts of such parasites, so as to ensure the presence in spring of a sufficient number of the latter. A study of the biology of the polyphagous parasites and their hosts is therefore recommended.

MORDVILKO (A.). **Heteroecious and anolocyclic Anoeciinae. Anolocyclic Lachninae.**—*Bull. Acad. Sci. U.R.S.S.* (Cl. Sci. math. nat.), no. 6, pp. 871–880, 11 refs. Leningrad, 1931.

An account is given of the life-history of various species of *Anoecia* and of some genera of anholocyclic LACHNINAE. It is deduced from their biology that certain species have become anholocyclic owing to the disappearance of their primary food-plants as a result of climatic changes.

[CHIGAREV (G.).] **Чигарев (Г.). On the Application of Soil-mulching for the Control of soil-inhabiting Pests.** [*In Russian.*]—*Plant Protection*, viii, no. 3, pp. 249–256. Leningrad, September 1931. (With a Summary in English.) [Recd. 1932.]

In the course of work on the fumigation of soil infested with insect pests, investigations were made on the effect of applying a covering of a special kind of thick paper, tarred roofing felt, or iron sheets, immediately after the fumigant has been scattered loosely on the soil surface.

Factors affecting the evaporation, diffusion and absorption of fumigants in the soil, and the way in which these processes would be modified by applying such coverings are discussed, and an account is given of field experiments on a small scale carried out in the summer of 1930 in the northern Caucasus and western Transcaucasia against *Phylloxera* on vine roots, and in 1931 near Pskov against Lamellicorn larvae in sandy forest soil. In the case of *Phylloxera*, calcium cyanide, paradichlorobenzene and other fumigants were used, the soil being heavy and damp. All stages of the Aphid were killed to depths varying from 6 to 20 ins. when the fumigants were applied under covers, whereas only a low rate of mortality was obtained when they were introduced into the soil in the usual way. Similar results were obtained with calcium cyanide against the Lamellicorn larvae. In the soil covered with tarred roofing paper all the larvae were killed in 4 days, whereas in a plot fumigated in the usual way they were unaffected.

[Zakharov (L. Z.).] **Захаров (Л. З.). The Question of the Migratory Locust Control.** [*In Russian.*]—*Plant Protection*, viii, no. 3, pp. 257–265. Leningrad, September 1931. [Recd. 1932.]

For a long time it has been recognised that final success in the control of *Locusta migratoria*, L., in the Northern Caucasus cannot be attained until work is concentrated on the permanent breeding grounds. So far, however, no real advance has been made in this direction, and throughout the last five years the infested area has remained very large. This is mainly due to the fact that the breeding grounds still remain unstudied, and the causes of locust multiplication in them unknown. It is suggested that fluctuations in the level of rivers may be responsible for outbreaks [*cf. R.A.E.*, A, xix, 334], but exact data are lacking. Defects in the existing control organisation and technique are also held responsible for the incomplete success of control work.

[Puzuirnuiĭ (R.).] **Пузырный (Р.). The Clover Cutworm** (*Scotogramma trifolii* **Rott.).** [*In Russian.*]—*Plant Protection*, viii, no. 3, pp. 267–274, 7 refs. Leningrad, September 1931. [Recd. 1932.]

An account is given of field and laboratory observations on *Scotogramma trifolii*, Rott., carried out in the summers of 1927 and 1928 in the Poltava and Kharkov Governments, where the larvae caused serious damage to sugar-beet. The geographical distribution of this Noctuid is outlined, and all stages are described. There are three overlapping generations a year, the larvae being present in the field from May till the end of September. Hibernation occurs in the pupal stage. In the insectary moths fed on sugar and water lived 7–11 days at 17·7°C. [64°F.]. Oviposition takes place on the fourth or fifth day after pairing, eggs being laid singly or in batches on the upper and lower surface of the leaves of beet and *Atriplex patula*. The average number of eggs laid by a female under artificial conditions was 167. The egg and larval stages last 4–9 and 18–45 days respectively. Pupation occurs in the soil at a depth of about 1 in., and the adults emerge in 7–19 days. The chief damage to beet is caused by the first generation, when the plants are still weak and undeveloped. In the insectary the larvae were successfully bred on *Atriplex patula*, *Sonchus oleraceus*, *Amarantus blitum* and clover, but only fed readily on *Atriplex*.

Of first generation larvae collected in 1928 about 25 per cent. were attacked by insect parasites and about 18 per cent. by fungi and bacteria. For control, the beet should be sprayed with barium chloride or with 3–4 oz. Paris green and 6–8 oz. lime to 9 gals water. The pupae may be destroyed by digging the soil, and the adults, when abundant, should be trapped with molasses baits.

[Esterberg (L. K.).] **Эстерберг (Л. К.). Sugar Beet Web Worm (*Loxostege sticticalis* L.) in the District of Nizhni-Novgorod in 1929–1930.** [*In Russian.*]—*Plant Protection*, viii, no. 3, pp. 275–292. Leningrad, September 1931. (With a Summary in English.) [Recd. 1932.]

An account is given of observations on the biology of *Loxostege sticticalis*, L., in Nizhniĭ-Novgorod, where this Pyralid does not usually occur unless the moths are carried by strong winds from their permanent breeding foci in the southern steppe regions of Russia. In 1929, swarms of moths appeared in the first half of June, and at the end of the month larvae were abundant on weeds and various crops. The resulting adults were on the wing in the first half of July, together with others that had been carried in by a continuous south-east wind and could easily be distinguished by their worn appearance. The moths fed on the nectar of flowers to such an extent that there was a shortage in the production of honey and the bees had to be artificially fed. The eggs were chiefly laid on *Chenopodium album*, and the larvae of the second generation preferred to feed on weeds. Owing to crowded conditions, however, they migrated to crops, sometimes covering distances of nearly a mile and defoliating deciduous trees on their way. Serious damage was caused to flax, clover, and various root crops, but cereals were usually only attacked when all the other food-plants had been eaten. The larvae began to enter the soil on 8th August, as many as 50 cocoons per sq. ft. occurring in infested plots. About 64 per cent. of the larvae hibernated, the remainder emerging as adults in the second half of August. In the spring of 1930, an average of 21·65 per cent. of the cocoons contained larvae or pupae that had been killed by fungous and bacterial diseases, and about 50 per cent. had been emptied by rooks and other birds. The moths were observed from 18th May till the end of July; in many of the districts their appearance again coincided with the occurrence of strong south-east and south winds. The great majority died before reaching maturity, and the reproductive capacity of the few that oviposited was not high. The larvae only infested weeds. Adults of the first generation were on the wing during August, but as most of them were worn specimens and had well-developed ovaries, they were evidently immigrants. All stages disappeared in the autumn.

The part played by natural enemies was insignificant. In 1929, the larvae in the southern districts were readily attacked by *Carabus estreicheri*, Fisch., *C. besseri* var. *haeres*, Fisch., *Calosoma denticolle*, Gebl., and *C. maderae* var. *auropunctatum*, Hbst. *Apanteles ruficrus*, Hal., parasitised up to 10–14 per cent. of the larvae of the second generation and pupated in August in cocoons attached to plants, the adults emerging in the same month. A hyperparasite, *Habrocytus crassinervis*, Thoms., emerged from about 50 per cent. of the cocoons. *Pales pavida*, Mg., *Zenillia* (*Exorista*) *mitis*, Mg., *Eulimneria rufifemur*, Thoms., *E. geniculata*, Grav., and *Mesochorus tuberculiger*, Thoms., were also

reared from mature larvae of *Loxostege* between the end of July and 10th September, and *Tachina* (*Larvaevora*) *noctuarum*, Rond., *Zele calcarator*, Wesm., *Meteorus chrysophthalmus*, Nees, *Phytodietus segmentator*, Grav., *Cryptus viduatorius*, F., *C. dianae*, Grav., and *Omorgus* sp. were obtained from overwintered larvae in the spring of 1930.

[Masaĭtis (A. I.).] **Масайтис (А. И.). On the Morphology of the *Selatosomus spretus* Mannh. Larvae.** [*In Russian.*]—*Plant Protection*, viii, no. 3, pp. 293–297, 4 figs. Leningrad, September 1931. (With a Summary in English.) [Recd. 1932.]

A description is given of the chief morphological characters of the larvae of the Elaterid, *Corymbites* (*Selatosomus*) *spretus*, Mannh., with particular reference to those differentiating them from the larvae of *C.* (*S.*) *latus*, F., in association with which they usually occur, both species being widely distributed throughout Siberia.

[Il'inskiĭ (A. M.).] **Ильинский (А. М.). A new Method of quantitative-statistical Analysis of Red Spider Infestation** (*Epitetranychus althaeae*). [*In Russian.*]—*Plant Protection*, viii, no. 3, pp. 299–301. Leningrad, September 1931. (With a Summary in English.) [Recd. 1932.]

In the course of observations in Transcaucasia on *Tetranychus telarius*, L. (*Epitetranychus althaeae*, v. Hanst.) on cotton, the degree of infestation was estimated by samples obtained by gently pressing infested leaves against a sheet of smooth paper coated with an adhesive. The mites remained fixed by their backs to the paper, on the dark surface of which they were clearly perceptible, and as the living individuals continued to move their legs they were readily distinguished from dead ones. Usually the mites remained alive for several hours. Gum arabic appeared to be the best adhesive, as, though it dried out in 15–30 minutes, the mites were not killed, whereas glues of the type of " tanglefoot " were toxic to them. The eggs did not stick to the paper and had to be counted on the leaves. As cotton leaves have very thick veins, some of the mites may not be reached by the adhesive if the coating is too thin.

[Yaroslavtzev (G. M.).] **Ярославцев (Г. М.). A brief Report on the Pests of Field Cultures in 1930 according to the Data of the State Service of Dynamics and Distribution of the injurious Insects.** [*In Russian.*]—*Plant Protection*, viii, no. 4, pp. 375–413, 7 maps, 1 ref. Leningrad, October 1931. (With a Summary in English.) [Recd. 1932.]

Brief notes are given on the distribution and seasonal occurrence of, and the extent of the damage caused by, over 80 of the more important insect pests recorded from various parts of the Russian Union in 1930. Most of them are dealt with under the crops attacked, but separate sections of the report are devoted to locusts and grasshoppers, which did not cause any appreciable damage, and to the following insects, which occurred in various parts of European Russia : *Phytometra* (*Plusia*) *gamma*, L., a severe outbreak of which was checked by parasites and diseases ; wireworms, which seriously damaged cereals and sunflowers ; *Euxoa* (*Agrotis*) *segetum*, Schiff., which caused considerable

losses in the yield of sugar-beet and winter cereals; and *Loxostege sticticalis*, L., which was the most important of the polyphagous pests, particularly on beet, sunflowers, and maize. In the northern districts about 50–80 per cent. of the larvae were killed by parasites and diseases, and most of the adults that were on the wing in August in the south did not oviposit. The chief pests of winter cereals in various parts of the Russian Union were *Hylemyia coarctata*, Fall., *Chaetocnema aridula*, Gyll., and *C. hortensis*, Geoffr. *Apamea* sp. caused serious damage to spring-sown wheat and oats in the central Volga region, the adults being on the wing from late July to late September, and *Oscinella frit*, L., and *Mayetiola destructor*, Say, to winter and spring-sown wheat in the steppe region of the Ukraine and to spring-sown wheat in western Siberia, where *O. frit* also infested barley and *M. destructor* winter rye. *Anisoplia austriaca*, Hbst., destroyed the entire crop of wheat in some districts in the northern Caucasus. *Phyllotreta vittula*, Redtb., caused considerable injury to beet in the central Volga region and to crucifers in central Russia. *Bruchus pisorum*, L. (*pisi*, L.) was very abundant on peas in the Ukraine, and *Tetranychus telarius*, L. (*Epitetranychus althaeae*, v. Hanst.) on soy-beans in the northern Caucasus and near Kharkov. *Hypera* (*Phytonomus*) *nigrirostris*, F., injured 10–51 per cent. of the shoots and inflorescences of clover in the Vladimar, Smolensk and Leningrad Governments. Serious pests of sugar-beet included *Bothynoderes punctiventris*, Germ., in the southern Ukraine, and *Cassida nebulosa*, L., the second generation larvae of which destroyed 60 per cent. of the plants in a south-western district of the Central Black Soil Zone. *Aphthona euphorbiae*, Schr., and *Longitarsus parvulus*, Payk., caused considerable injury to flax in the Moscow Government, and *Pyrausta nubilalis*, Hb., to hemp in central Russia and the Nizhniĭ-Novgorod Government, and maize in the northern Caucasus. *Tanymecus palliatus* F., was the most important pest of young sunflower plants in the central and lower Volga regions, and *Opatrum sabulosum*, L., destroyed 70–90 per cent. of the sprouting sunflowers in the northern Caucasus. Severe damage to swede seedlings in the Smolensk Government was caused by *Phorbia* (*Chortophila*) *brassicae*, Bch., and mustard in the lower Volga region was attacked by *Pieris daplidice*, L., and *Lixus ascanii*, L. *Athalia colibri*, Christ (*spinarum*, F.) and *Pieris brassicae*, L., were present in numbers on crucifers in central Russia.

[Strachitzkiĭ (K.).] **Страчицкий (К.). On the Factors causing the Appearance of Burns on the Leaves of Plants treated by the Arsenic-containing Preparations.** [*In Russian.*]—*Plant Protection*, viii, no. 4, pp. 421–432, 10 refs. Leningrad, October 1931. (With a Summary in English.) [Recd. 1932.]

Laboratory and field investigations on injury by arsenicals to the foliage of a variety of plants showed that the damage is only caused when penetration occurs into the inner cells of the leaf-tissue of soluble arsenic dissolved by the action of atmospheric carbon dioxide in the presence of moisture and by that of the leaf secretions, which contain mineral salts and organic acids. Insoluble arsenicals, such as lead arsenate, do not injure the plants. Under conditions of high humidity, the appearance of foliage injury was retarded at temperatures varying from 4 to 11·2°C. [39·2–51·8°F.], whereas at higher ones scorching

occurred in most cases within 24 hours. Under the influence of protracted rainfall, the cuticle of the leaves of certain plants, which otherwise is practically impenetrable to liquids, swells and becomes much more penetrable. In a rainy summer, the cuticle develops insufficiently and the plants would be more susceptible to injury than in a dry one.

[Ritus (T.) & Savzdarg (E.).] **Ритус (Т.) и Савздарг (Е.). Ferrous Sulphate and Calcium Polysulphides in the Control of Apple Sucker Eggs.** [*In Russian.*]—*Plant Protection*, viii, no. 4, pp. 433–438. Leningrad, October 1931. (With a Summary in English.) [Recd. 1932.]

In experiments with eggs of the apple leaf-sucker [*Psylla mali*, Schm.] on apple twigs, factory-prepared and home-made lime-sulphurs, at a concentration of 7° Bé, gave average mortalities of 96 and 91·7 per cent. respectively, and 5, 10 and 15 per cent. concentrations of hydrated ferrous sulphate killed 52·2, 60·2 and 54·3 per cent. The ferrous sulphate sprays tended to clog the nozzle of the sprayer, whereas the lime-sulphur did not. A combination of 5 per cent. lime and 5 per cent. ferrous sulphate killed 64·4 per cent., and one containing 10 per cent. of each material killed 83·3 per cent. ; a 10 per cent. spray of lime alone killed 83·8 per cent. The efficiency of spring spraying largely depends on thorough wetting of the twigs, 2–3 gals. of spray being required for a tree 30–40 years old.

Toll (S. G.). **Einige Beobachtungen über *Bupalus piniarius* L. aus der Staatlichen Oberförsterei Klosnowo (Nord-Polen).** [A few Observations on *B. piniarius* from the State Forest, Klosnovo (northern Poland).]—*Polsk. Pismo ent.*, x, pt. 3–4, pp. 229–235. Lemberg, February 1932.

In mid-April 1931 the author obtained 1,200 pupae of *Bupalus piniarius*, L., from a forest in northern Poland, and placed 600 on a layer of sand outdoors, covered with moss and daily sprayed with water, while the other 600 were kept in a room at a higher temperature (22°C. [71·6°F.] by day and 18°C. [64·4°F.] by night). Details of the emergence of the adults under these conditions are shown in tables. Emergence in the room lasted from 4th to 26th May and in the open from 20th May to 13th June. Both sexes emerged simultaneously and in almost equal numbers, with a slight preponderance of males. Brief notes are given on the numbers of unidentified Ichneumonids and Tachinids that emerged from some of the pupae and on aberrant forms of the moth.

[Silant'ev (I. M.).] **Силантьев (И. М.). Chief Pests of Fodder Crops.** [*In Russian.*]—Demy 8vo, 216 pp., 198 figs., numerous refs. Moscow, Gosud. Izd. s.-khoz. kolkh.-koop. Lit. [State Pub. Agric. Co-op. Lit.], 1931. Price 2 *rbl.* 25 *kop.*

This popular handbook on the chief insects injurious to fodder crops in the Russian Union contains a general brief account of the anatomy, physiology, metamorphosis, biology, and importance of insects and the morphology of the chief orders injurious to fodder plants, with notes on methods of collecting the pests and estimating the damage done. Thirty pages are devoted to control measures. The bulk of the book

consists of separate chapters dealing with polyphagous pests and those confined to grasses, leguminous plants, cruciferous root-crops, beet and carrots. After each chapter a list of the Russian literature on the subject is given.

ADLE (A. H.). **Persia : Insect Pests.**—*Int. Rev. Agric.*, xxiii, no. 1, p. M 5. Rome, January 1932.

Icerya purchasi, Mask., has for some years caused serious damage to *Citrus* in the Caspian Provinces of Persia. It also attacks pomegranates, figs and other plants, and apparently shows no marked preference for *Citrus*. The introduction of the Coccinellid, *Rodolia* (*Novius*) *cardinalis*, Muls., for its control is being considered. *Parlatoria zizyphus*, Lucas, and *Chrysomphalus pinnulifer*, Mask. (*minor*, Berl. & Leon.) were also observed [on *Citrus*], and lime-sulphur sprays were applied against them. Serious injury [to cereals], which averaged from 40–45 per cent. and in some districts amounted to as much as 90, was caused by *Eurygaster integriceps*, Put., in the Veramine region. In badly infested areas over 100 tons of the bugs were collected and burnt, and similar measures were begun in October in the mountains to prevent hibernation. A species of *Telenomus* was reared from eggs of this Pentatomid.

[KRASNYANSKIĬ (A. I.).] **Краснянский (А. І.). The Activities of the Entomological Section of the Anapa Zonal Experiment Station for Viticulture and Wine-manufacture and the Necessity for their further Expansion and Development in Accordance with Modern Requirements.** [*In Russian.*]—*Vestn. Vinogr. Vinodel. Vinotorg. S.S.S.R.*, iii, no. 12, pp. 759–762. Odessa, December 1931.

This is a brief survey of the work carried out by the Entomological Department of this Station on the Black Sea coast of the northern Caucasus in 1924–28 and 1931. A list is given of 50 pests of vine observed in the district, arranged under their orders and families.

[MAKAROV-KOZHUKHOV (L. N.).] **Макаров-Кожухов (Л. Н.). Contribution to the Elucidation of some Questions on *Phylloxera* in the Kuban Region.** [*In Russian.*]—*Vestn. Vinogr. Vinodel. Vinotorg. S.S.S.R.*, iii, no. 12, pp. 776–782, 1 ref. Odessa, December 1931.

Observations in the Kuban region of the northern Caucasus in 1928–30 indicated that if recently planted vine slips are infested by *Phylloxera*, 75 per cent. are killed in the year of attack and all in the following year, irrespective of the variety of vine, type of soil or character of the locality. If slips are attacked in their second year, a few may survive, whereas a considerable number of those attacked in their third year are resistant, and stocks 5–6 years old are not affected. Larvae on the roots are scarce in May and June (probably owing to unfavourable temperature conditions, including sudden fluctuations that are common in the Kuban region), but increase in the first half of July, the maximum being reached in mid-August, when they migrate from the upper to the lower layers of the soil. In mid-September they are again scarce ; a large percentage of those of the first instar are killed in the autumn, probably by the excessive moisture of the soil. Owing to the shortness of the period when *Phylloxera* is present in numbers and to a well

developed root-system, the older vines are able to resist infestation. In the Kuban region the spread of *Phylloxera* is very slow. This is due to the fact that the vineyards are always separated by rows of trees, and only rootless slips are planted, which reduces the possibility of infestation of a new vineyard to a minimum. Moreover, the vines are placed 6½ ft. apart, which distance the larvae can seldom cover when migrating on the surface of the ground. Owing to the custom of planting slips in small pits in ploughed ground, the roots are stimulated to grow deep down into the soil without spreading sideways, and the danger of infestation by larvae migrating in the soil, which occurs if the roots adjoin, is practically eliminated. Instances, however, have been recorded of the rapid spread of infestation by means of water carriage after heavy rains.

PASQUIER (R.). **Un dangereux ennemi du dattier : le Boufaroua.**—*Rev. Hort. Agric. Afr. N.*, xxxvi, no. 2, pp. 36–40. Algiers, February 1932.

Serious injury to dates in Algeria was caused in 1927 and 1930 by a mite, believed to be *Paratetranychus heteronychus*, Ewing [*cf. R.A.E.*, A, x, 354 ; xv, 593 ; xvi, 69]. The mites hibernate on the palms themselves or in the débris nearby and become active in the spring as soon as the nights begin to grow less cold, but in normal years do not cause noticeable damage. The conditions that favour serious infestations have not been determined. It is thought, however, that lack of humidity plays an important part, since outbreaks develop in the hot period from May to July, during or following dry winds, and usually occur in poorly irrigated plantations or on the outskirts of an oasis. The injury caused is described, an early attack, in which the inflorescence may be completely killed, being the most serious. In experiments with a number of sprays and dusts, sulphur dust mixed with an inert carrier (1 : 3) gave the best results. It should be applied when the mites first appear on the young dates at the top of the spike.

ESTÈVE (G.) & MALBRANT (R.). **La lutte contre les Acridiens au Tchad. Un procédé rapide et pratique de destruction des criquets.**—*Agron. colon.*, no. 170, pp. 33–34. Paris, February 1932.

In the Chad region (French Equatorial Africa) bands of locust hoppers are driven into rivers and lakes, which are very numerous during the rainy season. The hoppers are then easily collected in large quantities by means of baskets.

PETTEY (F. W.). **The Codling Moth and Experiments for its Control in Apple Orchards of the High Veldt during 1930–31.**—*Sci. Bull. Dept. Agric. Un. S. Afr.*, no. 104, 30 pp., 5 figs. Pretoria, 1931. [Recd. March 1932.]

The results of some of these experiments against the codling moth [*Cydia pomonella*, L.] on apples, conducted in South Africa during 1930–31, are comparable with those obtained during the previous year [*R.A.E.*, A, xix, 59]. All the sprays in the tests were thoroughly applied at a pressure of 250 lb., and the time for spraying was determined by catches of moths in enamel buckets containing crude treacle and water (1 : 15), suspended near the tops of the trees and examined every 3 days. The periods of the peaks of the emergence of the three

generations of moths were 13th–22nd October, 27th–30th December and 14th–17th February. When three varieties of apples in orchards surrounded by neglected ones were treated with 9 sprays of lead arsenate at normal strength ($1\frac{3}{4}$ lb. to 40 gals. water), the percentages of infestation (plus "stings") were 19·3, 12·4 and 23·6. When the amount of lead arsenate in the last 8 sprays was doubled and calcium caseinate added at the rate of $\frac{1}{4}$ lb. to 40 gals., the percentage of infestation was reduced to 3·9, 4·7 and 8·2, respectively. The calcium caseinate does not appreciably increase the efficiency of the spray, but facilitates the removal of the arsenical residue, and renders the spray stains less conspicuous. Doubling the strength of the lead arsenate in the case of early-maturing varieties is hardly justifiable, since it does not increase to any great extent the degree of control. A programme of 9 sprays of normal strength lead arsenate in which fish-oil ($\frac{1}{4}$ pint to 40 gals.) was added in the first 7 as an adhesive gave almost as effective control as the same number of sprays of double strength lead arsenate, and was considerably less expensive. Since, however, fish-oil renders the removal of the spray residue more difficult, its use after the middle of November on late maturing varieties is not recommended, and it should only be employed in the calyx sprays on early maturing apples, especially if they are to be exported. Only a grade containing less than 5 per cent. fatty acid and free from stearin should be used. The addition of 1 per cent. medium or light grade summer oil with 40 per cent. nicotine sulphate (1 : 1200) and calcium caseinate to the 3rd, 5th and 7th sprays in the standard lead arsenate spray programme gave satisfactory control of severe infestations of the woolly aphis [*Eriosoma lanigerum*, Hausm.]. Similar sprays containing more nicotine sulphate (1 : 800), calcium caseinate and no oil gave equally good results and improved the control against *C. pomonella*. A programme of double strength lead arsenate with a spreader, in which nicotine sulphate (1 : 800) was added in the 3rd spray to control *E. lanigerum*, gave almost as good results against *C. pomonella* as the standard one with 1 per cent. medium grade oil and spreader added to the 3rd, 5th and 7th sprays, and nicotine sulphate (1 : 1200) added to the 3rd and 5th. A combined cryolite and fish-oil spray [*cf. loc. cit.*] did not give satisfactory control.

Bait trap records showed that though the moths emerge daily in the orchards of the high veldt during the spring and summer, the bulk appear over short periods. It was found that birds may remove so many moths from the bait containers as seriously to interfere with the determination of the maximum emergence periods. To prevent this, the buckets were covered with $\frac{1}{2}$ in. mesh wire netting, which did not prevent the moths from reaching the bait.

McClean (A. P. D.). **Bunchy Top Disease of the Tomato.**—*Sci. Bull. Dept. Agric. Un. S. Afr.*, no. 100, 28 pp., 8 pls., 28 refs. Pretoria, 1931. Price 3*d*. [Recd. March 1932.]

This paper deals with investigations, carried out at Durban during 1926–30, on bunchy top of tomatos. This disease, which is thought to be due to a virus, was first observed in 1926 and has only been found in the low-lying districts of the eastern Transvaal. It was readily transmitted by grafting or juice inoculation, but not experimentally by *Eriophyes cladophthirus*, Nal., or the Aphid, *Macrosiphum* sp. A single transmission was obtained with *Macrosiphum*, but is not considered significant.

Mossop (M. C.). **Notes on a Mymarid Parasite of the Eucalyptus Snout-beetle** (*Gonipterus scutellatus*, **Gyll.), and its Introduction into South Africa.**—*Sci. Bull. Dept. Agric. Un. S. Africa*, no. 81, 19 pp., 7 figs., 6 refs. Pretoria, 1929. Price 3*d*. [Recd. April 1932.]

An account is given of the introduction of the Mymarid, *Anaphoidea* sp. [*A. nitens*, Gir. (*gonipteri*, Ferr.)] from Australia into the Union of South Africa and its liberation for the control of *Gonipterus scutellatus*, Gir., a pest of certain species of *Eucalyptus* [*cf. R.A.E.*, A, xix, 447, etc.]. The technique followed in transporting, rearing and liberation is described. In the field the females of the parasite are 2–3 times as numerous as the males. The severity of the infestation by *Gonipterus* in some plantations was considerably reduced two seasons after the parasites had been liberated, and in one locality where sewage was used for irrigation the trees appear to have almost completely recovered. The author considers that this practice may prove fatal to the weevil larvae hibernating in the soil and thus tend to control the first generation, which is scarcely affected by the parasite.

du Plessis (C.). **Termites in Buildings.**—*Fmg. S. Afr.*, 1931, reprint no. 74, 7 pp., 4 figs. Pretoria, October 1931. [Recd. March 1932.]

Notes are given on termites attacking woodwork, etc., in buildings in South Africa. Their life-history is briefly discussed, and methods for the treatment of wood with preservatives and the destruction of colonies by fumigants are described. In Natal, where termites are destructive, in erecting public buildings the reinforced concrete floors are suspended and not, as is usual, built on earth filling, and a course of 24-gauge galvanised sheet-iron, lapped, rivetted and soldered at the seams, which covers the whole of the sleeper walls, is built into the foundation walls on all sides and under all floors. It is bedded in 5 : 1 cement mortar, and the two brick courses above are built and flushed up solid in similar mortar, so as to leave no tracks for the termites. A damp course, in walls, of asphaltic sheeting is provided for all the buildings, and this acts as an additional deterrent to termites working up through the inside walls. In the Transvaal, Orange Free State and Cape Province, a termite proof course is built into foundation walls as above described for wood floors, but the concrete floors are laid on earth filling as the termites do not appear to be so troublesome. A space of not less than 24 ins. from ground to underside of the floor joist is left under floors, and access openings are formed in foundation walls to allow a person to crawl under the floors for inspection purposes. The underside of concrete floors and the foundation walls under the floors are limewashed. Before building operations are begun, all termite colonies are destroyed, and after the foundation walls are built, the area enclosed by the building is thoroughly saturated with a solution of copper sulphate, 1 lb. to 15 gals. water.

The grass-carrying termites of the genus *Hodotermes* do not attack woodwork, but often tunnel in walls and destroy wallpaper. It is practically impossible to locate their nests, and the only method of control found effective is a bait of finely chopped forage moistened with a solution of 1 lb. sodium arsenate and 1 gal. crude syrup or 8 lb. brown sugar in 8 gals water. The bait should be placed about the house and under the floors.

Wood Borers in Australia. Part I. *Lyctus,* **or the Powder Post Beetle.** —*Trade Circ. Div. For. Prod. Counc. Sci. Ind. Res. Australia,* no. 6, 14 pp., 5 figs. Melbourne, 1931. [Recd. March 1932.]

This is the first of a series of circulars, intended for the use of the timber industry in Australia, giving practical information on the various types of wood-boring insects, their methods of attack and measures for their control, based on practical experience and on literature from Australia and other countries. In this circular the bionomics and control of beetles of the genus *Lyctus* [*cf. R.A.E.*, A, xiii, 228 ; xviii, 288] are discussed, and methods for distinguishing them from other borers are described.

Cummins (J. E.). **The Preservative Treatment of Fence Posts (with particular Reference to Western Australia).**—*Pamph. Counc. Sci. Ind. Res. Australia,* no. 24, 34 pp., 8 figs. Melbourne, 1932.

An account is given of the methods for the preservation of timber, particularly that used for fence posts in Australia, and the principal causes responsible for the deterioration of the wood, such as decay, termites and boring beetles, are discussed. The construction of a simple plant for treating the timber, and methods for preparing solutions and treating the posts are described in detail ; and schedules of the times required for treatment of nine species of Western Australian timber, using water-soluble or oil preservatives, are given, with estimates of the cost.

Strickland (A. G.). **Removal of arsenical Spray Residue from Apples.** —*Fruit Wld. Australasia,* xxxiii, no. 2, pp. 77–78, 1 diag. Melbourne, 1st February 1932,

An account is given of experiments in Victoria in the fruit season of 1930–31, which showed that concentrations of ½ and 1 per cent. hydrochloric acid were effective in removing excessive arsenical residue from apples. Methods of washing and rinsing the fruit suitable for the average grower and for the smaller packing sheds are described, and equipment used in other countries is discussed.

Frappa (C.). **Sur la présence à Madagascar de** *Pseudococcus filamentosus* **Ckll., cochenille nuisible aux caféiers.**—*Rev. Path. vég. Ent. agric.*, xviii, fasc. 10, pp. 305–311, 10 refs. Paris, December 1931. [Recd. March 1932.]

Pseudococcus filamentosus, Ckll., the distinguishing characters of which are indicated, was first observed on coffee (*Coffea arabica*) in Madagascar in 1928 and has since become increasingly injurious. Brief notes are given on its distribution and history. It has not been found in Madagascar outside the plateau region around Lake Itasy, or on any plant except cultivated coffee, but has been reared accidentally in the laboratory on young pomegranates. Its life-history in Madagascar is not yet completely known, but the young larvae were observed to emerge from the ovisac at the end of October and during November, or about the beginning of the hot and wet season, and soon attached themselves to the extremities of the young twigs or to the bases of the leaf petioles. Female adults are to be found all the year round within waxy and cottony secretions that may measure as much as an inch

across, fixed at the leaf axils and sometimes enclosing fragments of dried leaves or branches. In old-established plantations the damage caused by this Coccid is hardly noticeable, as injured branches are quickly replaced by new growth, but in new plantations infestation spreads quickly and sometimes involves patches of as many as 50 bushes. Young bushes that have been attacked in November by larvae that are then hardly visible are within 3 months covered with white secretions and quickly become completely withered.

P. filamentosus appears to have a number of natural enemies in Madagascar ; several undetermined Cecidomyiids have been obtained in laboratory breeding. A few predacious Coccinellids, such as *Cydonia lunata*, F., and *Chilocorus* sp., are often found on coffee bushes in the neighbourhood of the Coccids. Control measures adopted include the destruction of severely infested bushes and treatment of lightly infested ones with insecticides. The best results were obtained with a lime-sulphur spray made by boiling 3 lb. lime and 2 lb. sulphur in 1 gal. water and afterwards diluting the mixture to 10 gals. The concentration was doubled in making applications in wet weather, and no scorching of the bushes was subsequently observed.

Nicholls (H. M.). **Thrips.**—*Tasmanian J. Agric.*, iii, no. 1, pp. 18–21. Tasmania, 1st February 1932.

A general account is given of the Thysanoptera, with recommendations for their control taken from the literature. Large numbers have recently been observed in orchards in the Tamar district, in Tasmania, and though no apparent damage was caused, some of the individuals received for indentification agreed in all respects with *Thrips imaginis*, Bagn., a species that is causing severe injury in Victoria and New South Wales.

Fourth Annual Report on Noxious-weeds-control Research carried out at the Cawthron Institute, Nelson.—*Ann. Rep. Dept. Sci. Ind. Res. N.Z., 1930–31*, reprint 1 p. Wellington [N.Z.], 1931. [Recd. March 1932.]

Notes are given on the progress of investigations on the biological control of noxious weeds in New Zealand [*cf. R.A.E.*, A, xviii, 464]. The adults of *Coraebus rubi*, L., which is being studied with a view to the control of blackberry, attack the foliage of economic rosaceous plants, such as raspberry, strawberry and apple, though the larvae appear to feed only on blackberry and rose. As a result of successful rearing of *Apion ulicis*, Forst., 560 weevils were liberated on gorse [*Ulex europaeus*] at Nelson and Alexander [*cf.* xix, 537]. Reproduction was more rapid under conditions in New Zealand than in Britain. A total of 1,670,600 eggs of *Tyria jacobaeae*, L., obtained from moths from a large consignment of pupae sent from England by the Imperial Institute of Entomology, were liberated on ragwort [*Senecio jacobaea*] throughout the Dominion [xix, 234]. Field surveys showed that this moth is gradually becoming established, and in some cases its influence on ragwort is noticeable. To obtain more complete control of this weed other insects are being imported. A large consignment of prepupae of the sawfly, *Antholcus varinervis*, Spin., was obtained from Chile for the control of piripiri [*Acaena*] ; by the end of March pupation had begun.

Report on Forest Biological Control Research carried out at the Cawthron Institute, Nelson.—*Ann. Rep. Dept. Sci. Ind. Res. N.Z., 1930–31,* reprint 1 p. Wellington [N.Z.], 1931. [Recd. March 1932.]

The entomological work of the Forest Biological Research Station during 1930–31 consisted chiefly of studies of various species of bark-beetles, the most important being *Hylastes ater*, Payk., a Scolytid recently discovered in various districts in New Zealand, especially where plantations of pines had been partly destroyed by fire or by indiscriminate cutting. Investigations dealing with the control of *Sirex* [*juvencus*, L.] by *Rhyssa persuasoria*, L., are not yet sufficiently advanced to give any indication of the effect of the parasite, as acclimatisation problems have not been completely overcome. A further parasite, *Ibalia* [*leucospoides*, Hochenw.], is being imported. Investigations on the spruce aphis [? *Neomyzaphis abietina*, Wlk.] revealed the fact that defoliation of spruce is caused as much by an associated pest, the conifer spinning mite [? *Paratetranychus ununguis*, Jac.].

Fulmek (L.). *Micromus pusillus* **Gerst. (Neuropt.), als Feind der Tabak Blattlaus** (*Myzus persicae* **Sulz.).** [*M. pusillus*, an Enemy of the Tobacco Leaf-aphis, *M. persicae*.]—*Misc. zool. sumatrana*, lx *B*, pp. 3–4. Medan, January 1932.

Micromus pusillus, Gerst., is predacious on *Myzus persicae*, Sulz., infesting tobacco in Deli, Sumatra. The egg stage of this Hemerobiid lasts 3 days. The mature larva spins a cocoon and remains in it for 2 days before pupating, and the pupal stage lasts 5 days. The adults remained alive for 10 days in captivity, feeding on the Aphids.

van der Meer Mohr (J. C.). **Dierlijke plagen der tabak.** [Pests of Tobacco in Deli in 1931.]—*Meded. Deli Proefst.*, (2) no. 73, pp. 20–27, 1 map. Medan, 1931. [Recd. February 1932.]

In 1931 tobacco in Deli, Sumatra, was severely attacked by *Heliothis assulta*, Gn., *Phytometra signata*, F., and *Prodenia litura*, F. Infestation by *Myzus persicae*, Sulz., was less intense than in previous years. *Phthorimaea heliopa*, Lw., was very injurious in some plantations ; it appears restricted to tobacco and hibernates on tobacco plants that are growing wild. *Acheta* sp., *Gryllotalpa africana*, P. de B., *G. hirsuta*, Burm., and *Brachytrypes portentosus*, Licht., were troublesome in seed-beds. As these crickets occur where the ground is damp and well covered with plant litter, the paths between seed-beds and the sides of drains should be kept free from such shelter. *Nezara viridula* L., was more numerous than in the preceding year.

Uichanco (L. B.). **A simple Device for fumigating Woodwork of Buildings with Carbon Bisulphide.**—*Philipp. Agric.*, xx, no. 9, pp. 593–595. Laguna, P.I., February 1932.

Owing to the prohibitive price of hardwoods, many inferior varieties of soft wood continue to be used in buildings and furniture in the Philippines, and, consequently, the householder has constantly to contend with infestations of destructive insects. Among the most serious pests of woodwork are certain Bostrychids and Lyctids, damage by which is characterised by an accumulation of piles of fine, woody

faecal powder, and at least three species of termites, *Calotermes* (*Cryptotermes*) *cynocephalus*, Light, *C.* (*C.*) *nocens*, Light, and *Coptotermes vastator*, Light, the presence of which can be determined by an accumulation of coarse, compressed faecal pellets of wood. Remedial measures should be applied as soon as these signs of infestation are noticed.

The smaller borers and the termites were found to be most satisfactorily controlled by placing a wad of cotton-wool (about half the size of a hen's egg), dipped in carbon bisulphide, against the opening of the tunnels and covering the whole with a double thickness of newspaper saturated with water so that the edges adhere firmly on all sides to the wood. The water forms a continuous sheet surrounding the carbon bisulphide and having a lower specific gravity than the fumigant prevents it from escaping except down the galleries. The covers remain in position at least over-night ; one or two applications of the treatment were sufficient to destroy most colonies. A method of determining the position of the opening of termite tunnels by the nature of the piles of pellets during the initial stages of attack is described. In more advanced infestations, the cavities may be located by tapping the wood near the pellets, and a small opening may be made in the upper part of the cavity for treatment.

The openings of the tunnels of the large Bostrychids, such as *Xylothrips flavipes*, Ill., are fairly large and there are only a few of them together on a piece of infested board ; a small bit of treated cotton-wool can be inserted into each hole, which can then be sealed with soft soap or clay.

Infestation by Lyctids is not usually noticed until a large area of wood is riddled with minute openings. If the infestation is not too far advanced, it can sometimes be treated successfully with carbon bisulphide, the cotton-wool being tacked above the openings so that the gas can get into the holes.

ARAKAWA (H. Y.). **The Pear Flower Bud Weevil in S. Manchuria.** [*In Japanese.*]—*Res. Bull. Agric. Expt. Sta. S. Manchuria Rly. Co.*, no. 5, pp. 13–39, 7 pls. Koshurei, Manchuria, September 1931. (With a Summary in English.)

Anthonomus pomorum, L., occurred in large numbers in 1930 at Tokuriji, Manchuria, causing serious damage to the pear crop. It has one generation a year, hibernation taking place in sheltered places in the adult stage. The beetles, which begin to be active in April and decrease in numbers in May, feed on the flowers and lay their eggs singly on the buds. The egg, larval and pupal stages last 5–8, 20 and 6–9 days respectively. The newly emerged adults feed on the leaves of apple, pear, peach, etc., beginning to become dormant in mid-August. Mating does not occur before hibernation. Spraying with lead arsenate in April and the collection of the weevils and infested buds are recommended for control.

MARUMO (N.). **Applied Entomology.** [*In Japanese.*]—494+48 pp., 461 figs. Tokyo, Kokin-Shoin, 1931. Price *Yen* 4·80.

The morphology and biology of insects and methods of controlling them are dealt with generally in this work, which includes a detailed account of insecticides and brief notes on the more important insect pests of Japan.

Kuwana (I.) & Muramatsu (K.). **Some Scale Insects of the Genus** *Parlatoria*. [*In Japanese.*]—*J. Plant Prot.*, xix, no. 1, pp. 8–17, 1 pl. Tokyo, January 1932.

Descriptions are given of various species of *Parlatoria* collected on plants imported into Japan from abroad, including *P. pyri*, Marl., on pear from Manchuria, *P. mangiferae*, Marl., on mango from Formosa, *P. blanchardi*, Targ., from California, and *P. pseudopyri*, sp. n., on *Jasminum* from Hongkong.

Takahashi (S.). **The northern Extension and Boundary of Distribution of** *Schoenobius bipunctifer* **Wlk. (Paddy Borer) along the Coasts of the Pacific and the Japanese Sea in Japan.** [*In Japanese.*]—*J. Plant Prot.*, xix, no. 1, pp. 27–34. Tokyo, January 1932.

At present the northern boundary of the distribution of the rice borer, *Schoenobius bipunctifer*, Wlk., is 33° 43′ N. Lat. in the Wakayama Prefecture on the Pacific coast, and 34° 24′ in the Yamaguchi Prefecture on the Sea of Japan.

Kanzawa (T.). **On the Control of** *Phylloxera*, **a Pest of Grape, and the Utilisation of immune Stocks.** [*In Japanese.*]—*J. Plant Prot.*, xix, no. 1, pp. 53–57. Tokyo, January 1932.

Phylloxera was first observed on vines in Japan in 1910 in the Yamanashi Prefecture. Brief mention is made of various immune stocks selected as a result of experiments

Oda (F.) & Tateishi (G.). **Machine Oil Emulsion as a Summer Insecticide for** *Ceroplastes rubens*, **Mask., on Persimmon** (*Diospyros kaki*). [*In Japanese.*]—*J. Plant Prot.*, xix, no. 1, pp. 66–70. Tokyo, January 1932.

A two per cent. lubricating oil emulsion applied during the summer hatching period gave 92–99 per cent. control of *Ceroplastes rubens*, Mask., on persimmon (*Diospyros kaki*) without injury to the trees.

Meyrick (E.). **Exotic Microlepidoptera, iv, pt. 7.**—pp. 193–224. Marlborough, Wilts., the author, March 1932. Price, 3*s* per part.

The new species described include the Tineids, *Dichomeris granivora*, reared from a larva in young maize cob in Trinidad, and *Rhadinastis serpula*, bred in April from a larva feeding in a twig of the tea plant in Formosa.

Mendes (L. O. Teixeira). **Uma nova especie do genero** *Neoterius* **(Col., Bostrychidae), broca de** *Vitis vinifera* **L.** [A new Species of *Neoterius* boring in the Grape-vine.]—*Rev. Ent.*, ii, fasc. 1, pp. 27–32, 12 figs., 1 ref. S. Paulo, 23rd January 1932. (With a Summary in English.)

A Bostrychid, *Neoterius vitis*, sp. n., is described from Brazil where it was found boring in the smaller branches of grape-vines. The genus is peculiar to South America. A key is given to the 5 species of the subgenus *Dolichobostrychus*, including this new one.

Borgmeier (T.). **Sobre alguns Phorideos que parasitam a Saúva e outras formigas cortadeiras (Diptera, Phoridae).** [On some Phorids parasitising *Atta* spp. and other Leaf-cutting Ants.]—*Arch. Inst. biol. Defesa agric. anim.*, iv, pp. 209–228, 5 pls. S. Paulo, 1931. (With a Summary in English.)

A list is given of Phorids that are parasites of leaf-cutting ants of the genera *Atta* and *Acromyrmex* in Brazil [*cf. R.A.E.*, A, xvii, 280], arranged under their hosts. The following new species are described: *Apocephalus neivai*, *A. barbicauda*, *Myrmosicarius infestans* and *M. persecutor* from *Acromyrmex* spp.; *M. biarticulatus* from *Eciton praedator*, F. Smith; and *M. diabolicus* from a variety of *Solenopsis saevissima*, F. Smith.

Esaki (T.). **A short Course of Lectures on the Insect Pests of the Rice Plant. Leafhoppers.** [*In Japanese.*]—*Mater. Control Ins. Fung. Pests Rice Plant*, no. 38, pp.1–38. Fukuoka, Kyushu, February 1932.

A list is given of 65 Homopterous insects known to occur on the rice plant in the Japanese Empire, of which *Deltocephalus dorsalis*, Motsch., *Delphacodes striatella*, Fall., *Nephotettix apicalis* var. *cincticeps*, Uhl., *Sogata furcifera*, Horv., and *Nilaparvata oryzae*, Mats., are the most important in Japan proper. An account is given of their natural enemies, and their life-histories and control are discussed. Outbreaks of these insects in rice-fields have been known in Japan since A.D. 701, those of the years 1732 and 1897 being very severe. K. Takada published an account of the transmission of a virus disease of rice by *Nephotettix apicalis* var. *cincticeps* in 1900 (*Rep. Shiga-ken Agric. Expt. Sta.*, no. 2), this being the first record of the transmission of a plant disease by insects.

Daguerre (J. B.). **Una nueva plaga forestal en la Provincia de Buenos Aires.** [A new Forest Pest in the Province of Buenos Aires.]—*Rev. Soc. ent. argent.*, iii, no. 6, p. 332. Buenos Aires, 25th November 1931. [Recd. February 1932.]

The Cerambycid, *Diploschema rotundicolle*, Serv., has been observed in the Province of Buenos Aires boring in the tips of the branches of *Melia azedarach*, a forest-tree hitherto immune from insect attack.

Glenn (P. A.). **Use of Temperature Accumulations as an Index to the Time of Appearance of certain Insect Pests during the Season.**—*Trans. Illinois Acad. Sci.*, xxiv, no. 2, pp. 167–180. Springfield, Ill., December 1931.

An account is given of the author's findings, which are confirmed by the results of subsequent work in Illinois, on the possibility of forecasting the dates when the various stages of the codling moth [*Cydia pomonella*, L.] may be expected to appear on the basis of day degrees [*R.A.E.*, A, x, 479]. Some evidence has been obtained that the effective temperature for the codling moth may be applied to other insects with comparable life-cycles that are not affected to any large degree by humidity or other factors. Accumulative temperatures based on atmospheric conditions cannot, however, be depended upon to indicate when insects that hibernate underground will emerge.

Bigger (J. H.). **Grape *Colaspis* as a Corn Pest in Illinois.**—*Trans. Illinois Acad. Sci.*, xxiv, no. 2, pp. 235–240, 5 refs. Springfield, Ill., December 1931.

This is a record of further investigations in Illinois [*R.A.E.*, A, xvi, 507] during 1926–29 on the life-history and control of *Eucolaspis* (*Colaspis*) *brunnea*, F., the larvae of which are particularly injurious to maize following clover. The adults are found during June–September, chiefly in fields of red clover, and the eggs are probably laid at the base of the plants during July-August. The first date on which larvae were found by the author was 20th September (in 1928) and the latest date 1st July (in 1926). The larval life lasts about 9 months. Pupation takes place in cells 2–3 inches deep in the soil, about 6 inches from the food-plant. The pupal stage lasts 2–3 weeks. The larvae have been recorded as destroying up to 78 per cent. of a field of maize. Rotation of crops and timely ploughing of red clover on land where maize is to be planted give the best control.

Overley (F. L.) & Overholser (E. L.). **Some Factors influencing Spray Injury on Apples.**—*Proc. Washington St. Hort. Ass.*, xxvii (1931), pp. 23–30, 4 refs. [Olympia, Wash., 1932.]

The following is taken from the authors' summary of the results of experiments in Washington on various effects of summer oil sprays on apple trees : Mineral oil may cause falling of the fruit and leaves if applied in the first or second cover sprays, when lime-sulphur has been used either in the delayed dormant, pink or calyx sprays. Oil of a light, medium type (65–70 seconds viscosity) can be safely used if it is properly emulsified and combined with other materials for at least four cover sprays on normal growing trees without apparent reduction in size and colour of the fruit. The heavier oils (85–100 seconds viscosity) with three or more applications may reduce the size of the fruit and the amount of bud formation on heavily laden trees. Insects injuring the leaves and nitrogen fertilisers are often responsible for reduction in the colour of the fruit. Injury from an excessive number of applications of oil sprays is most likely to result under the following conditions : when the trees are heavily laden with fruit ; when they are low in vitality or suffering from injury to their roots ; when there is an inadequate supply of available water or nutrition in the soil ; or when the air temperatures at the time of spraying are above 90°F. and the relative humidity comparatively high. Certain varieties appear to be more susceptible to injury from oil sprays than others. The behaviour of the stomata of the leaves of one variety tested was not appreciably affected by six applications of light medium oil and lead arsenate, compared with lead arsenate alone, when sufficient soil moisture was available.

Webster (R. L.). **Red Spider Control.**—*Proc. Washington St. Hort. Ass.*, xxvii (1931), pp. 17–21. [Olympia, Wash., 1932.]

Webster (R. L.). **Orchard Mites and their Control.**—*Better Fruit*, xxvi, no. 8, pp. 10–11. Portland, Ore., February 1932.

Infestation of various fruit trees by mites is becoming increasingly serious in the north-western United States, particularly in the Wenatchee district of Washington. Owing to their habit of obtaining nourishment by sucking or rasping the surface of the leaf, they

are little affected by the lead arsenate sprays applied against the codling moth [*Cydia pomonella*, L.], and, by reducing the functional leaf area, the injury they cause influences the size and colour of the fruit. Brief notes are given on the bionomics of *Bryobia praetiosa*, Koch (brown mite), *Tetranychus telarius*, L. (common red spider) and *Paratetranychus pilosus*, C. & F. (European red mite), all of which may be present on the same tree at the same time, though usually one of the species eventually predominates, and *Phyllocoptes schlechtendali*, Nal. (rust mite) and *Eriophyes pyri*, Pag. (blister mite). The value of dormant sprays in their control is discussed. In the experimental orchards, lime-sulphur used against mildew, rotenone, and combinations of oil and pyrethrum or oil and nicotine gave good control of *T. telarius*. The last-named spray is also effective against *C. pomonella*. One U.S. gallon summer oil emulsion may be added to 2 lb. lead arsenate in 100 U.S. gals. water in the late cover sprays against the first brood of *C. pomonella* for the control of mites. If *T. telarius* is present, 1½ U.S. gals. oil emulsion may be necessary to ensure adequate control, particularly when a medium oil (65–75 seconds viscosity) is used. Control measures should be carried out early in the season, as difficulties are experienced in the removal of arsenical residue when oil is used with or follows lead arsenate in August.

Spuler (A.), Dorman (R.) & Gillies (K.). **Factors influencing the Cost of Codling Moth Control.**—*Proc. Washington St. Hort. Ass.*, xxvii (1931), pp. 31–43, 13 diag. [Olympia, Wash., 1932.]

Spuler (A.) & Dorman (R.). **Factors limiting the Use of Lead Arsenate for Codling Moth Control.**—*Better Fruit*, xxvi, no. 8, pp. 5–7, 5 figs. Portland, Ore., February 1932.

Infestation of apples by the codling moth [*Cydia pomonella*, L.] in Washington during 1931 was severe in some orchards, owing to faulty timing and application of spray treatments. Studies were undertaken to discover a treatment that, in addition to controlling *C. pomonella*, would be of use against mites, Aphids, leaf-hoppers, etc., to develop a material that would not injure the tree or leave excessive residue on the fruit, and to reduce the cost of spraying. It is concluded that lead arsenate is the most effective of the stomach poisons, and its effectiveness increases fairly rapidly up to a concentration of 3 lb. to 100 U.S. gals. water, at which point it gives 65 per cent. control. A higher percentage is then better obtained by the addition of spreaders, an ovicide or both, than by an increase in the spray deposit. The best materials for improving the spray coverage with lead arsenate are spreaders, fish-oil and mineral oil ; owing to its giving a relatively high deposit of lead arsenate, fish-oil is the most satisfactory from the point of view of control. Spreaders give the best results when used with 3 lb. lead arsenate to 100 U.S. gals. water. Mineral oil and fish-oil with 2 lb. lead arsenate to 100 U.S. gals. water gave 65–70 per cent. control, which was little increased by a larger amount of lead arsenate. The ovicidal value of fish-oil is practically equal to that of mineral oil when used in similar amounts. Herring oil was the most satisfactory of the fish-oils. Tests have shown that in a combination with 2 lb. lead arsenate and 100 U.S. gals. water 1 U.S. quart fish-oil is as effective as 1 U.S. gal. mineral oil, even though the ovicidal value of the mineral oil is greater owing to the larger amount used. A further reduction of 50 per cent.

larval infestation was obtained with this combination as compared with lead arsenate alone.

Barium fluosilicate, potassium fluoaluminate, mineral oil, nicotine sulphate, pyrethrum and rotenone all appear to be of little value against *C. pomonella* when used alone. Mineral oils are chiefly of value as ovicides ; those having a viscosity of 70 seconds Saybolt and used at the strength of 1 per cent. showed an ovicidal value of 85–90 per cent. on eggs of *C. pomonella*. They improve the coverage of lead arsenate and when combined with it have given excellent results, though the problem of residue removal and the cost of materials have limited their use. The use of mineral oil with nicotine sulphate or pyrethrum increases the time the nicotine or pyrethum remains on the fruit, and the spray combines both ovicidal and larvicidal properties and controls other pests such as Aphids and mites. A spray of oil (1 : 100) combined with nicotine sulphate (1 : 1600) proved as effective against *C. pomonella* as lead arsenate when used in any or all of the cover sprays, and also controls other pests and avoids an excessive deposit of arsenical. The costs of various treatments are discussed.

Two years' work indicates that the addition of spreaders to brands of lead arsenate with no deflocculator adds little to the insecticidal value of the spray, whereas their addition to those containing a deflocculator results in a marked improvement in its value. It appears that modifying the spray mixture so that the particles of lead arsenate remain longer in suspension may detract from its value as an insecticide and that the spreader has this effect, except in brands of lead arsenate containing a deflocculator, so that the change in suspension rate offsets the improvement in spray coverage.

NEWCOMER (E. J.) and others. **A Codling Moth Control Schedule for 1932.**—*Proc. Washington St. Hort. Ass.*, xxvii (1931), pp. 46–50, 1 diag. [Olympia, Wash., 1932] ; also in *Better Fruit*, xxvi, no. 8, pp. 8–9, 1 diag. Portland, Ore., February 1932.

The control of the codling moth [*Cydia pomonella*, L.] on apples in Washington is further discussed [see preceding paper]. The omission of the calyx spray in the control programme is not recommended. Oil at 0·75 per cent. (equivalent to approximately 0·9 gals. commercial oil emulsion to 100 gals.) gave about 90 per cent. mortality of the eggs during tests. Oil emulsions may be safely used with lead arsenate in the second and subsequent cover sprays, provided that lime-sulphur has not been applied too late in the spring. After July they must be combined with some other insecticide, such as nicotine sulphate ($\frac{1}{2}$ or $\frac{2}{3}$ pint per 100 gals.) or a fluorine compound, such as cryolite (sodium fluoaluminate) or barium fluosilicate, at the rate of 3 lb. to 100 U.S. gals. Cryolite proved very effective in 1931, in some cases more so than lead arsenate. It is estimated that chemically treated bands kill about 33 per cent. of the larvae leaving the apples. A programme for the control of *C. pomonella* is given.

MURRAY (C. W.). **Compatibility of Acid Lead Arsenate with Commercial Oil Emulsions as used in the Pacific Northwest.**—*Proc. Washington St. Hort. Ass.*, xxvii (1931), pp. 52–56. [Olympia, Wash., 1932.]

In the north-western United States oil emulsions are extensively used to increase the adhesiveness of lead arsenate sprays against the codling moth [*Cydia pomonella*, L.]. Experiments were therefore undertaken

with various commercial lead arsenates and oil emulsions to test the compatibility of the components by estimating the soluble arsenic (arsenic oxide) in the spray. There was considerable difference in the individual commercial acid lead arsenates, disregarding any deflocculator or spreader that may have been incorporated in the insecticide, which may have been a physical difference, such as size of particle. The amount of soluble arsenic varied according to the mixtures. The presence of low percentages of soluble arsenic in certain of the lead arsenates may be due to the presence of comparatively large amounts of basic lead arsenate. Comparatively large amounts of soluble arsenic were found in mixtures of lead arsenate with oil emulsions containing ammonia and with a commercial pine tar soap. It is well known that ammonia and alkalis react with acid lead arsenate to form a soluble arsenate salt and a basic lead arsenate. It was found that about 67 to 83 per cent. of the total soluble arsenic is formed at the end of about the first hour.

Diehl (H. C.) & Fahey (J. E.). **The Effect of Fish and Mineral Oil Sprays in Problems of arsenical Spray Residue Removal.**—*Proc. Washington St. Hort. Ass.*, xxvii (1931), pp. 57–60, 1 chart. [Olympia, Wash., 1932.]

Owing to the difficulty in removing arsenical residue from apples sprayed with fish-oil or mineral oil and lead arsenate, a preliminary study was carried out in 1930 on the efficacy of the principal commercial washing treatments for such fruit. The fruit had received six cover sprays and was washed for 40 seconds with a commercial alkaline solution at 115°F., or hydrochloric acid at different temperatures, to which salt was added in one case and salt and kerosene emulsion in another. Only those fruits sprayed with mineral oil and lead arsenate and washed with the salt, kerosene and hydrochloric acid mixture at 100°F., and those sprayed with the fish-oil and lead arsenate and treated with the alkaline solution were cleaned to and below the point of tolerance. In the latter case the efficacy was probably brought about by the action of the alkaline wash on the fats and fatty acids of the fish-oil, by which the lead arsenate particles are released from the waxy or oil coating of the apple and are then presumably more readily affected by the alkaline solvent. This has also been observed in commercial practice where the fruit has accumulated wax on its surface before washing and has been cleaned with alkaline washes without difficulty.

Mote (D. C.) & Wilcox (J.). **Redberry Mite of the Blackberry.**—*Proc. Washington St. Hort. Ass.*, xxvii (1931), pp. 203–207. [Olympia, Wash., 1932.]

In 1930, 50–90 per cent. of the blackberry crop in the Willamette Valley, Oregon, did not ripen owing to the depredations of *Eriophyes essigi*, Hassan [*R.A.E.*, A, xx, 21]. The mites pass the winter in or near the buds and are relatively inactive. When the flower buds appear they work down into the developing drupelets, where they feed and multiply until autumn. Apparently reproduction is not rapid until midsummer. In one season's tests on control, a programme consisting of an autumn and a pre-blossom spray gave the best results, though a dormant spray is considered the most important in California [*cf.* xiv, 247]. The use of one of the following programmes is recommended

until further experiments are made : an autumn spray of 8 per cent. liquid lime-sulphur (30° Bé.) applied to the new canes as soon as the old ones have been cut and removed from the field, and a pre-blossom spray of 5 lb. wettable sulphur to 100 U.S. gals. water on the flower buds before they have opened ; or a dormant spray of 6–8 per cent. lime-sulphur (30° Bé.) applied in the late winter or early spring before the buds begin to grow, and a wettable sulphur pre-blossom spray.

LUDWIG (D.). **The Effects of Temperature on the Development of an Insect** (*Popillia japonica* **Newman**).—*Physiol. Zool.*, i, no. 3, pp. 358–389, 9 figs., 33 refs. Chicago, 1928. [Recd. April 1932.]

The following is the author's summary :—Different stages of *Popillia japonica*, Newm., are not affected to the same degree by temperature. The threshold, optimum and maximum temperatures are different for each stage. The egg and pupal stages are very regular in their temperature responses ; but the larval stages are modified by other factors such as food and the inception of a resting stage. The presence of wheat in the food seems to hasten the development of those stages not affected by the resting stage, but the total larval period is not affected, since the resting stage is correspondingly longer.

The temperature coefficients (Q_{10} values) are not constant for any stage. They diminish regularly as the temperature is increased for each stage, except the third instar larval stage, which is modified by the behaviour of the other larval stages.

The temperature characteristics (μ values), as derived from Arrhenius' formula, are not constant for any stage. They diminish regularly as the temperature is increased, except for the third instar larval stage.

Krogh's formula, that the rate of development is increased in direct proportion to the increase of temperature (within certain limits), has been found to apply to the egg and pupal stages. The number of day-degrees required for the complete life-cycle is not constant for the different temperatures, but increases with the temperature.

The effects of alternating temperatures, as compared with constant temperatures representing their mean values, depend upon the temperatures involved : if one of the temperatures is above the optimum of development and the other is between the threshold and the optimum, development seems to be retarded ; if both of the temperatures are between the threshold and the optimum, neither an acceleration nor a retardation of rate is produced ; if one of the temperatures is below the threshold and one is between the threshold and the optimum, the development seems to be accelerated.

LUDWIG (D.). **The Effect of Response to Cold on the embryonic Development of the Japanese beetle** (*Popillia japonica* **Newman**).—*Physiol. Zool.*, iii, no. 3, pp. 291–296, 2 figs., 7 refs. Chicago, July 1930. [Recd. April 1932.]

Normally the eggs of *Popillia japonica*, Newm., are laid during July and August and hatch before the cold weather. The winter is always passed in the larval stage, so that normally the eggs are probably not exposed to temperatures below the threshold of development. The results of these experiments, which are described, show rhythmic changes in susceptibility to cold. There is a period during which

exposure produces a very high mortality, but very little retardation in the rate of development. There is also a period of decreased susceptibility as measured by mortality, but of increased susceptibility as measured by the retardation produced. There is a period of greater susceptibility during which both the mortality and retardation of development are increased, and there is also a period near the end of the embryonic development during which both mortality and the extent of retardation are again decreased.

Fleming (W. E.) & Baker (F. E.). **Hot Water as an Insecticide for the Japanese Beetle in Soil and its Effect on the Roots of Nursery Plants.**—*Tech. Bull. U.S. Dept. Agric.*, no. 274, 41 pp., 13 figs., 24 refs. Washington, D.C., January 1932.

Experiments were carried out in New Jersey during 1920 and 1926–29 to determine the efficacy of immersing the subterranean portions of nursery plants in hot water for the control of *Popillia japonica*, Newm. (Japanese beetle) [*cf. R.A.E.*, A, x, 89 ; xvii, 175, 445 ; xix, 750]. A thorough and comprehensive study was made of the action of hot water on all stages of the beetle when removed from the soil. A total of 200 individuals was used in each of the tests, the method and apparatus used in which are described. It was found that immersion in water at a temperature of 112°F. for 70 mins. killed adults, pupae, pre-pupae, larvae and 99·72 per cent. of the eggs, and the treatment is therefore considered practically exterminative. A small percentage of beetles throughout their development were abnormally resistant to the action of heat, and experiments carried out with larvae of the third instar showed this resistance to be apparently influenced by the temperature of the top 6 ins. of soil. The lower the minimum temperature of the soil the longer the time that is required to kill the larvae ; with a temperature of 43°F. in November an immersion of 70 mins. is required to ensure mortality, and with one above 55°F. in May 25 mins. The average minimum temperature of the soil at a depth of 6 ins. at Moorestown was found to follow closely the normal temperature of the air. In this region soil moisture is unlikely to be a significant factor in the resistance of the larvae, and it is improbable that in any situation the weather conditions will influence resistance to such an extent that immersion for 70 mins. will not prove fatal. The importance of maintaining careful control over the temperature of the water and prolonging the treatment for a sufficient period to secure the insecticidal action is stressed.

Experiments carried out in the laboratory, greenhouses and nurseries to determine the effectiveness of the treatment in destroying infestations in the soil showed that hot water could be relied upon to destroy the immature stages of *P. japonica* in the soil about the roots of plants, provided that the infested soil was immersed in water brought up to 112°F. and held at this temperature for 70 mins. Several hours are required to heat relatively large masses of soil to the temperature of the surrounding water, and if it is necessary, for practical purposes, to limit this treatment to masses of soil that will register the required heat within 60 mins., only plants carrying less than 64 cu. ins. of soil about their roots can be treated.

The penetration of heat into soil immersed in hot water is affected by the type of soil ; and the time required is affected by the temperature of the soil before treatment and the quantity of water absorbed on immersion.

Experiments in the laboratory and in the nursery showed that a large number of dormant plants may be treated successfully, the varieties receiving treatment and its effect on their subsequent growth being shown in a table. Recommendations for the treatment of dormant or semi-dormant nursery plants are given.

EHRLICH (J.). **The Occurrence in the United States of *Cryptococcus fagi* (Baer.) Dougl., the Insect Factor in a menacing Disease of Beech.**—*J. Arnold Arboretum*, xiii, pp. 75–80, 3 refs. Lancaster, Pa., 1932.

Cryptococcus fagi, Bär., a pest of beech (*Fagus* spp.) in western Europe and the Maritime Provinces of eastern Canada, is recorded for the first time in the United States, severe local infestations having been found in Maine and Massachusetts. The destructive fungi that usually grow in the bark infested by this Coccid and which are causing the death of vast quantities of beech in Canada are apparently not yet present in the United States. The life-history in eastern America is similar to that in Europe [*cf. R.A.E.*, A, ii, 571], but in Nova Scotia and New Brunswick the eggs do not begin to hatch until about the end of July and the period of larval activity terminates by the end of September. In Boston this latter period lasts somewhat longer.

In tests with sprays in the late winter and spring of 1931, a commercial oil (1–15) was completely effective when thoroughly applied. Kerosene-soap emulsion (25 per cent.) gave good results, but lime-sulphur and nicotine sulphate were not satisfactory.

ROARK (R. C.). **Use of Economic Poisons to Safeguard Crops.**—*U.S. Daily*, 20th July 1931, 1 p. Washington, D.C., 1931.

This is a brief review of the ways in which various chemicals are used in the United States against insects and other pests of economic plants. It is estimated that 5,000,000 U.S. gals. of petroleum oil, 30,000,000 lb. of lead arsenate, and 30,000,000 lb. of calcium arsenate (the last-named largely against the cotton boll weevil [*Anthonomus grandis*, Boh.]) are used annually as insecticides. In Southern California in 1927 nearly 6,000,000 *Citrus* trees were fumigated with hydrocyanic acid gas at a cost of about £420,000 [at par]. Insect pests cause an estimated loss of about £400,000,000 annually in the United States, and without the use of chemicals for their control, the commercial production of some of the most important crops would be impossible.

HAAG (H. B.). **Toxicological Studies of *Derris elliptica* and its Constituents. I. Rotenone.**—*J. Pharmacol.*, xliii, no. 1, pp. 193–208, 2 figs, 10 refs. Baltimore, Md., September 1931.

The following is largely taken from the author's summary: As a result of experiments carried out to determine the toxicity of rotenone by various methods of administration to laboratory animals, it appears that there is little danger of acute poisoning in healthy subjects following the ingestion of sprayed food. Preliminary studies showed that certain organs had undergone fatty changes during chronic poisoning. In many cases guineapigs died when subjected to a dust containing rotenone, and therefore workers exposed to such a dust should be provided with suitable masks.

ROARK (R. C.). **New Fumigants for destroying Insect Pests in Foodstuffs.**—*Food Industries*, 1931, pp. 398–399, 26 refs. New York, N.Y., September 1931.

The author reviews from the literature the recent research undertaken in the United States on new fumigants for stored foodstuffs, of which the most promising are ethylene dichloride mixed with carbon tetrachloride, ethylene oxide, particularly when mixed with carbon dioxide, and ethyl formate.

JONES (H. A.). **Carbon Tetrachloride may replace Ether in the Extraction of Rotenone. Preliminary Report.**—*Ind. Engng. Chem.*, News edn., ix, no. 19, p. 301. Easton, Pa., 10th October 1931. [Recd. March 1932.]

Ether has been used by the majority of recent investigators for the extraction of rotenone from the roots of *Derris* (*Deguelia*) sp. and cube (*Lonchocarpus nicou*). It was found, however, that in some cases the separation of the rotenone from the extract was slow and the gummy nature of the extract rendered filtration difficult, and in others the separated crystalline material contained little or no rotenone. Carbon tetrachloride was therefore substituted for ether, as its solvent powers for rotenone are very similar Rotenone separates from solutions in carbon tetrachloride as a solvate containing one mole of solvent to one of rotenone. It separated from the evaporated carbon tetrachloride extracts of most roots more readily than from the corresponding ether extracts, and the amounts obtained were similar. It appears that carbon tetrachloride gives a quicker and more selective separation of rotenone than ether. Two or three roots from which no rotenone could be separated by means of ether gave carbon tetrachloride extracts from which rotenone separated readily.

This solvent is also suitable for extractions on a large scale. When two samples of 2 kgm. of cube root were extracted simultaneously by percolation at room temperature, 60 litres of ether were necessary to extract the same amount of rotenone as was obtained with 35 litres of carbon tetrachloride. In both cases the rotenone separated readily from the evaporated extract and had a high degree of purity. When carbon tetrachloride was used, the loss of solvent was much less, and it is considered that a smaller quantity could have been used had the percolator been heated to a temperature of 60–70° [C.] during the extraction, as this increases the solubility of the rotenone. Heat cannot be used in the case of ether owing to its low boiling point. The solvate obtained in the extractions may be freed of its carbon tetrachloride of crystallisation by recrystallising from alcohol or by heating at 80–90° [C.] under reduced pressure, under which latter conditions the solvate does not melt. The amount of carbon tetrachloride lost in this way is practically negligible, being only 39 per cent. of the weight of the recovered rotenone. A further advantage of carbon tetrachloride over ether in the commercial extraction of rotenone is the absence of risk from fire.

HOUSER (J. S.). **Some Problems in economic Entomology.**—*J. Econ. Ent.*, xxv, no. 1, pp. 28–38. Geneva, N.Y., February 1932.

The following is taken from the author's abstract : A wise choice of the field of activity is one of the first problems confronting economic entomologists, some projects having been overworked and others

seriously neglected. Considerable judgment should be exercised in determining the attitude taken towards a newly introduced insect. A present need is for more basic fundamental research, but this line of endeavour is not likely to reach its highest state of development until financial support is placed upon a more stable foundation, possibly through the avenue of endowments. Other outstanding problems are the improvement in experimental technique, particularly as it applies to field plot work, and a more perfect correlation of entomological activities within the area served by the members of the American Association of Economic Entomologists.

Felt (E. P.) & Bromley (S. W.). **Observations on Shade Tree Insects.** —*J. Econ. Ent.*, xxv, no. 1, pp. 39–46. Geneva, N.Y., February 1932.

Very severe and general damage was caused in 1931 to shade trees in the north-eastern United States, where it is estimated that 1,750,000 trees were defoliated by three introduced insects, *Galerucella luteola*, Müll. (*xanthomelaena*, Schr.) on elm, *Plagiodera versicolor*, Laitch., on willow, and *Popillia japonica*, Newm. *Coleophora laricella*, Hb., was extraordinarily abundant on larch, and the depredations of these introduced insects was followed by widespread and serious damage by several native pests, particularly *Hyphantria textor*, Harr. (fall webworm) and *Thyridopteryx ephemeraeformis*, Haw., each of which is estimated to have seriously damaged 250,000 trees. *Datana integerrima*, Gr. & Rob., has been very injurious on walnuts. The total number of trees seriously affected by the first six insects is estimated at two and a half million with a total value of £50,000,000, and there are indications of even more sweeping damage in 1932.

The weakening of trees by several abnormally dry seasons and general loss of foliage has produced ideal conditions for serious damage by borers, especially *Scolytus quadrispinosus*, Say, on hickory, *Agrilus bilineatus*, Web. (two-lined chestnut borer) on oaks, and *A. anxius*, Gory, on birch. The flowering dogwood [*Cornus florida*] in one of the areas affected by drought showed an interesting correlation between the scorching of the bark by a light woodland fire and a serious and prompt invasion by *Chrysobothris femorata*, F. (flat-headed apple tree borer). Serious injury from infestation by borers is already apparent, and more severe damage may be expected in the next season or two.

The formulation of schemes for spraying in areas where these insects were numerous in 1931, supplemented by measures to accelerate the resumption of vigorous growth by trees as a precaution against borers, is urgently advised.

Searls (E. M.). **A preliminary Report on the Resistance of certain Legumes to certain Homopterous Insects.**—*J. Econ. Ent.*, xxv, no. 1, pp. 46–49. Geneva, N.Y., February 1932.

Observations in Wisconsin to test the apparent relationship noted in the previous season between variation in infestation by *Macrosiphum* (*Illinoia*) *pisi*, Kalt., of certain strains of canning peas and the colour of the latter confirmed the theory that the degree of Aphid infestation was directly proportional to the green colour of the plants. In the case of both individuals and varieties, the plants having the yellower colour were less infested by Aphids. A preliminary test with

lucerne showed that selections which varied towards yellow sustained less injury from *Empoasca fabae*, Harr., than those of greener hue, and an analogous condition was observed in the case of sweet clover, although no experiment was instituted to demonstrate either the nature or extent of the resistance.

Buchanan (D.). **A bacterial Disease of Beans transmitted by *Heliothrips femoralis* Reut.**—*J. Econ. Ent.*, xxv, no. 1, pp. 49–53, 10 refs. Geneva, N.Y., February 1932.

Although thrips are known to disseminate several virus diseases of plants, it does not appear that they have hitherto been proved experimentally to disseminate a bacterial disease. Controlled experiments in Minnesota, which were repeated several times, have now demonstrated that *Hercothrips* (*Heliothrips*) *femoralis*, Reut., is capable of transmitting a bacterial disease of beans. Of groups of bean plants in pots in a greenhouse at a temperature of 80°F., those kept free from thrips and not inoculated with bacteria remained vigorous and healthy, and those infested with disease-free thrips for reproduction grew well apart from showing typical feeding scars. Plants inoculated by spraying with a bacterial suspension, or by pricking into the leaves and stems bacteria from an agar culture, developed symptoms characteristic of this bacterial disease in due course ; and those infested with thrips that had previously fed on diseased plants developed symptoms closely associated in all cases with the feeding wounds made by the thrips and similar in all respects to those found on the artificially inoculated plants. The gross cultural characteristics of the bacteria isolated from lesions produced after the feeding by thrips and also by artificial inoculations were identical, but the specific identity of the bacteria has not yet been determined.

In preliminary experiments with individual thrips successful transmission was obtained by using thrips that had fed on diseased plants for only 40 minutes, although this point requires further verification. This, together with the fact that the incubation period following insect inoculation is not appreciably lengthened as compared with artificial inoculation, would indicate that transmission is mechanical. High temperature and humidity greatly enhance the rate of action of the disease on the plants.

Smith (C. E.) & Allen (N.). **The Migratory Habit of the Spotted Cucumber Beetle.**—*J. Econ. Ent.*, xxv, no. 1, pp. 53–57. Geneva, N.Y., February 1932.

A brief report is made of the observations and experiments conducted in Louisiana and northward through the Mississippi Valley relating to the seasonal habits of *Diabrotica duodecimpunctata*, F. (spotted cucumber beetle). This beetle regularly migrates northward during the spring and early summer, and the offspring migrate back to the south during the autumn, none surviving the winter north of central Missouri and no true hibernation occurring in the south [*cf. R.A.E.*, A, xx, 217]. The number of generations matured during this annual advance and retreat is not known.

A number of migratory flights observed during spring and autumn all occurred during periods of favourable winds, and a temperature of 60–65°F. was found to be necessary. The beetles cease feeding several

hours before a migratory flight, which differs in several respects from ordinary flights about the field, and usually crawl to the top of the plants on which they are feeding, or assemble on taller objects in the vicinity. Migration starts with each beetle apparently flying independently, but all going in the same general direction and at a speed considerably faster than that maintained in local flights. With high temperatures and favourable conditions flights are started in the late afternoon, probably reaching a maximum about dusk, but with lower temperatures such as prevail in early spring or late autumn, the flights may occur at any time during the day. A distance of 500 miles or more may be covered during 2–4 days in good weather, and aeroplane records show that altitudes up to 1,000 ft. or more may be attained during the flight. The first flight of the migration journey may be taken 48 hours after the beetles have emerged from the soil, although they usually become mature and mate before migration is completed. The number of flights required is indefinite, depending on weather conditions and the season. The period of migration is more prolonged in autumn. In the Mississippi Valley a large percentage of the beetles feed on lucerne in the spring both after emerging and between flight periods. In the autumn a similar habit prevails, but during the journey southwards, autumn flowering weeds are preferred.

JAYNES (H. A.). **Collecting Parasites of the Sugarcane Borer in South America.**—*J. Econ. Ent.*, xxv, no. 1, pp. 64–68. Geneva, N.Y., February 1932.

Studies of the parasites of *Diatraea saccharalis*, F., have been carried out since 1928 in Argentina, where the work was discontinued in May 1930 [*cf.* next paper], and in Peru. The most common parasite in Argentina was *Paratheresia claripalpis*, Wulp, others found in small numbers being *Ipobracon* spp., *Microdus* (*Bassus*) *stigmaterus*, Cress., *Apanteles xanthopus*, Ashm., and a Tachinid of the genus *Leskiomima*. *Telenomus alecto*, Cwfd., was found in the Province of Salta. In Peru, *P. claripalpis*, *Ipobracon rimac*, Wolcott, and *M. stigmaterus* were found. Over 637,000 puparia of *P. claripalpis* and 63,000 females of *I. rimac* were shipped during the period up to July 1931; the method of shipment of the former and the single consignment from Argentina have been already noticed [*R.A.E.*, A, xviii, 677]. During the second and third seasons in Peru, puparia were obtained in large numbers by purchase from farmers who had small patches of maize.

Egg-clusters of *D. saccharalis* collected in Argentina in 1929 were parasitised by both *Trichogramma minutum*, Riley, and *Telenomus alecto*. No *Telenomus* emerged from shipments of field-collected egg-clusters containing both species, although *Trichogramma* did so. A few individuals of the former emerged, however, from a shipment of 80 clusters containing 611 apparently parasitised eggs sent by aeroplane to New Orleans from Buenos Aires on 11th March 1930. A few cocoons of *M. stigmaterus* were sent from both Argentina and Peru.

Consignments of *Ipobracon* were shipped in both cocoon and adult stages, those from Argentina consisting of more than one species, whereas all those from Peru were *I. rimac*. The first shipment of adults by aeroplane was made from Peru to Miami, Florida, on 8th May 1931, 30·4 per cent. surviving. The adults were shipped in 1929 and 1930 in tin cans having small holes for ventilation and drainage. To the inside of each can was fixed a bottle with a wick for water and a

small cup to contain granulated sugar for food. The percentage of survival was very low when this method of transport was used, but with a crate devised later, 91·5 per cent. of the parasites arrived alive at New Orleans, 7 days after having been collected in Peru. This crate was made of thin wood, 12 ins. long, 9 ins. high and 6 ins. wide, with solid ends, bottom and top. The two sides were covered with wire screening and black cloth, with 3 or 4 strips of wood as a frame. To each end was nailed a small tin cup containing granulated sugar and a holder for a sponge and water. This consisted of a tin can, 4 ins. high by $1\frac{1}{2}$ ins. wide by 1 inch deep, tightly sealed except for an opening on one side at the bottom $1\frac{1}{2}$ ins. wide and $\frac{3}{4}$ inch high. At this point was soldered a cup-like arrangement, making an L-shaped container. In this lower portion a sponge was placed, which was kept moist by water in the tin.

Holloway (T. E.), Haley (W. E.) & Bynum (E. K.). **Receiving Parasites of the Sugarcane Borer in Louisiana.**—*J. Econ. Ent.*, xxv, no. 1, pp. 68–71, 2 refs. Geneva, N.Y., February 1932.

The headquarters of the work on the introduction of parasites of *Diatraea saccharalis*, F., into Louisiana, begun in Argentina in 1928 [see preceding paper], were subsequently transferred to Peru because the seasons in Argentina are exactly the reverse of those in Louisiana, so that when parasites were available in the former country they could not be released in the latter. *Paratheresia claripalpis*, Wulp, the most effective parasite in Argentina, was available in much larger numbers in Peru and at a time suitable for its release in Louisiana. This fly as well as the Braconids, *Ipobracon rimac*, Wolcott, and *Microdus* (*Bassus*) *stigmaterus*, Cress., have been sent from Peru to Louisiana, but *Microdus* was received in such small numbers that none was bred or released. Until 1931, all the parasites were shipped to New York in cold storage, the flies as puparia and the Braconids as adults, and re-shipped thence in special refrigerator cases to New Orleans, where they were allowed to warm up gradually before being released. The first shipment of *Ipobracon* was released directly in the sugar-cane fields, but later arrivals were fed for a day or so before being released.

The puparia of the flies were placed in emergence cages measuring 20 by 15 by 15 ins., and having a sleeve opening in front, a pane of glass at each end and a white cloth covering the back. The metal drawer at the bottom of such a cage would hold 10,000 puparia. The puparia were placed in the cage just as they arrived in the sphagnum moss in which they had travelled, the moss being kept damp and water being sprayed on the sides of the cage. Water and sugar were given to the flies. The latter, which emerged gradually, were collected by means of a suction device and transferred to cloth and wire cages, 36 by 13 by 16 ins., each having a sleeve opening and a top that was attached with wing bolts and could be removed. The flies were taken into the field in these cages and released. This type of cage was also used successfully for breeding both flies and *Ipobracon*.

Since the beginning of the work 16,161 Braconids and 107,424 flies have been released on 14 plantations in Louisiana, an average emergence of 21·5 per cent. of the flies and a survival of 24·6 per cent. of the Braconids having been obtained. The parasite insectary in which the boxes from Peru were opened is described. *Ipobracon rimac* was recovered in the cane fields in 1931, making it certain that it had completed at least one generation under field conditions.

Ingram (J. W.) & Douglas (W. A.). **Notes on the Life History of the Striped Blister Beetle in southern Louisiana.**—*J. Econ. Ent.*, xxv, no. 1, pp. 71–74. Geneva, N.Y., February 1932.

Epicauta lemniscata, F., has recently become an important pest of soy-beans, the principal leguminous crop of southern Louisiana, which when first introduced there had apparently no serious insect enemies. Severe injury has also been caused to the foliage of sweet pepper [*Capsicum*], tomato, potato and cabbage, and feeding has been observed upon a number of other plants, including rice, maize, mustard, egg-plant and carrot. The beetles first appear in May or June, emerging from the ground in widely scattered places, but soon collecting in soy-bean fields, where they are often so thick on the plants as to cover completely the leaves and branches. They move across the fields in a body, devouring the foliage in their path. After several days in a field the beetles begin to disperse to adjoining areas, and are usually present for about 3 weeks before disappearing. They move chiefly by crawling, flying little and mainly at night. After feeding for a week they begin to oviposit, for which purpose the female digs a hole in the ground about 1½ inches deep, the bottom of which opens out into an oval shaped chamber, where the eggs are deposited. The entrance is sealed when oviposition is completed, over 100 eggs being laid in a single cell, with a maximum of 187. Eggs have been deposited as early as 20th June and as late as 14th October. In confinement they are often laid on the surface of the soil, and when poisoned, the females often oviposit on the leaves of the food-plant or in cracks in the ground, though almost all such eggs are destroyed by fungi. The eggs hatch normally in 7–10 days, though in October they may require as long as 26 days ; they have been known to hatch as late as 9th November. The triungulin larvae, which are described, scatter long distances in search of food and have been known to live as long as 15 days without sustenance. The only larval food at present known is grasshopper eggs. The triungulin feeds for a few days and then changes to a form resembling a Carabid larva. After about 7 days it then changes to a scarabaeoid form, in which after 8 days it bores down 1–2 ins. beneath the grasshopper egg-pod on which it has been feeding. Under favourable conditions in the summer it forms a cell and pupates, the pupa resting in an upright position 3–4 inches below the surface. In late autumn, or under conditions unfavourable to the completion of the life-cycle, the scarabaeoid larva after boring down changes to a coarctate larva or pseudopupa, in which form it hibernates, changing to a scolytoid larva the following spring. The length of the scolytoid larval stage, during which no feeding has been observed, is 11–21 days, after which pupation occurs. In the field the usual emergence of beetles following rain gives rise to the belief that the pupal stage is prolonged in dry weather until rain, or that the very hard, dry soil delays the adults in coming out. The total length of the life-cycle is 35–50 days in summer, and there are as many as 3 generations a year with apparent overlapping owing to weather conditions.

Natural factors are of little importance in the control of this beetle [*cf. R.A.E.*, A, xvi, 389], but the adults and larvae are attacked by a fungus, probably *Botrytis delacroisi*, and the eggs by another fungus, belonging to the genus *Aspergillus*. In the field no exposed eggs have been observed that were not destroyed by the latter.

Observations of the life-history of *E. lemniscata* were facilitated by the use of glass observation tubes ⅜ inch in diameter, 6 ins. long and

open at both ends. A single individual of the stage to be observed was placed in soil in each tube with food if necessary. The tubes were then pushed downward into soil in earthenware jars, the conditions prevailing closely resembling those in the outside soil. The tubes could be pulled out for observation and replaced. It was found that the beetles emerged in the same length of time in the tubes as when not so confined.

HINDS (W. E.) & OSTERBERGER (B. A.). **Results of *Trichogramma* Colonization on Sugarcane Borer Damage in Louisiana in 1931.**—*J. Econ. Ent.*, xxv, no. 1, pp. 57–64, 5 refs. Geneva, N.Y., February 1932.

A review of the continuation in 1931 of work carried out in Louisiana since 1927 in the colonisation of *Trichogramma minutum*, Riley, for the control of *Diatraea* [*saccharalis*, F.] on sugar-cane [*R.A.E.*, A, xvi, 508 ; xvii, 720 ; xviii, 393], from the point of view of the destruction of borer eggs by parasitism, the moth population developed in the fields during the season (excluding the hibernating generation), and the percentage of cane joints showing one or more borer burrows to the joint when the cane is harvested, indicates conclusively a reduction of 30–50 per cent. of the prospective borer damage as a result of the colonisation of from 5,000 to 6,000 parasites to the acre at a favourable time. The cost of such protection ranged between 2 and 4*s.* an acre in 1931, but may be expected to be less if similar work should develop on a commercial scale.

The times for starting colonies of parasites are during the period of the first and second generation of the host eggs on maize, and on sugarcane soon after the oviposition for the second or third generation begins. It is essential that a fresh supply of host eggs should be available ; on maize these also include eggs of *Heliothis* [*obsoleta*, F.]. A marked increase in the percentage of eggs parasitised may be expected to appear in the colonised area within two weeks after the parasites are released, and parasites may be expected to spread from the colonised cuts into adjacent ones, especially in the direction of the prevailing light, mid-day air currents. Release of parasites in alternate cuts, chequer-board fashion, appears to be a safe procedure. If the first release is not successful, subsequent ones may be made throughout the summer until the eggs for the hibernating generation are laid. It should not be expected that the colonisation of *Trichogramma* will even approximately eliminate the borers, since the parasites depend on a certain degree of host density for their own maintenance, but an important measure of egg destruction may reasonably be expected, and extremely heavy infestations may be prevented.

CUTRIGHT (C. R.). **Small Plots in Codling Moth Field Experiments.**—*J. Econ. Ent.*, xxv, no. 1, pp. 74–77. Geneva, N.Y., February 1932.

A scheme is put forward for reducing the size of plots used in experiments for the determination of the effectiveness of different materials employed in controlling the codling moth [*Cydia pomonella*, L.]. A small orchard of uniform trees was secured and laid out to test the idea. Five plots, each of a single tree chosen at random, were employed for a given test. The results, which were sufficiently promising to

warrant a further trial, are shown in tables, and several objections to which the scheme might be considered open are discussed and discounted. The chief merit of the scheme is the great reduction in cost, time and labour involved.

FROST (S. W.). **Notes on the Control of the Codling Moth.**—*J. Econ. Ent.*, xxv, no. 1, pp. 77–83. Geneva, N.Y., February 1932.

A summary of the results of spraying and dusting experiments carried out in Pennsylvania over a period of 8 years for the control of *Cydia* (*Carpocapsa*) *pomonella*, L., on apples shows that the omission of the petal fall spray involves little additional injury. The omission of the fifth application, about 10 days later, results in considerably more damage. Slightly less injury occurred in sprayed than in dusted plots, though the difference was hardly appreciable. A 2 per cent. lime-nicotine dust without lead arsenate was successful in holding *C. pomonella* in check, and calcium arsenate and magnesium arsenate were found to be as effective as lead arsenate. Magnesium arsenate in combination with lime-sulphur caused no injury to the foliage.

LATHROP (F. H.) & SAZAMA (R. F.). **A Laboratory-Field Method for the Study of the Efficiency of Codling Moth Sprays.**—*J. Econ. Ent.*, xxv, no. 1, pp. 83–101, 1 pl., 2 figs., 2 refs. Geneva, N.Y., February 1932.

The following is taken mainly from the authors' summary : A method has been devised for the study of larvicidal efficiency of sprays used against the codling moth [*Cydia pomonella*, L.] by a combination of laboratory and field technique. An experimental block, consisting of six plots in an orchard containing only one variety of apple was treated by means of modern spray equipment, one plot being sprayed by the regular orchard spray crew, using lead arsenate and lime, and the other five plots being sprayed by the employees of the Bureau of Entomology. The treatments included lead arsenate with and without lime ; lead arsenate and lime with fish-oil added to the two applications for first brood larvae ; and lead arsenate and lime for the first brood followed by summer oil with or without nicotine sulphate for the second. The results were determined by two methods, the first of which consisted of the examination of fallen fruit at irregular intervals and of picked fruit at harvest time. By the second method samples of apples were taken from the spray plots at intervals throughout the season without disturbing the spray coating on them. To do this the following procedure was used : A pin, consisting of a piece of 12 gauge galvanised iron wire $4\frac{1}{4}$ inches long, sharpened at one end, was gently tapped into the calyx of an apple to a depth sufficient to impale it securely. The pin was then held firmly, and the stem of the apple severed by pruning shears. The pin bearing the apple was then placed in a hole in a stick long enough to hold 10 apples. The stick bearing 10 apples was placed in a cabinet constructed to hold 150 apples in such a way as to prevent any disturbance of the residue during transit to the laboratory. In the laboratory a ring of adhesive was placed about the calyx of each apple to prevent the larvae escaping along the supporting wire, and then 10 newly hatched larvae of *C. pomonella* were placed on each fruit. After being left for 10 days, the apples were examined to determine the percentage of larvae that

had entered them. The percentage of entrances was compared with the entrances in a series of apples from which the spray coating had been removed. The lead arsenate and lime spray was taken as a standard of comparison. The average larvicidal efficiency resulting from this treatment during the period of the first broodwas 8·2 percent.; during the period of the second and third broods it was 35·02 per cent.; and during the entire season it was 24·96 per cent. The addition of fish-oil to the first brood sprays increased the larvicidal efficiency of the treatment somewhat, although only half the standard amount of lead arsenate was used. Lead arsenate alone proved distinctly more efficient than lead arsenate with lime.

The larvicidal efficiency of the 2 per cent. summer oil spray was decidedly inferior to lead arsenate and lime, but examination of fruit from the orchard indicated that the deficiency in larvicidal effect is compensated for to a considerable extent by ovicidal action. In the orchard the summer oil spray was about as effective as the lead arsenate and lime spray when results are based upon the percentage of infested and "stung" fruit, though the percentage of infested fruit was larger. The orchard results show that the oil-nicotine spray was somewhat superior to lead arsenate and lime, probably as the result of superior ovicidal effects.

During the period of rapid growth of the apples, which coincided approximately with the period of activity of the newly-hatched larvae of the first brood of *C. pomonella*, the arsenical sprays failed to build up an effective spray coating on the fruit. From a practical standpoint this is probably compensated for to a large extent by the effects of the coverage on the foliage and the calyx. A sharp decrease in efficiency of the arsenical spray coating resulted from heavy rainfall. Distinct benefit was derived from careful application of sprays.

An examination of the degree of variation within the samples showed that the method gives a reasonable degree of accuracy, with results at least as reliable as those obtained in the usual orchard spray-plot experiments.

In the discussion that followed, C. M. Cutright said that in experiments, larvae of *C. pomonella*, after having been placed for about 20 minutes on glass cylinders previously sprayed with different materials, were observed to establish themselves very rapidly when subsequently placed on unsprayed fruit. In answer to an enquiry, Lathrop stated that with a 2 per cent. commercial oil emulsion alone, or 1 per cent. oil with nicotine, 1 : 1600, there was a decrease in coloration of the fruit of selected apples, but no material injury to foliage was observed.

G. L. Hockenyos stated that young larvae of *C. pomonella*, when placed on glass within a ring of droplets of different types of oil, were repelled by those that had dark colour or any odour, but in the case of pure white oils would move into the droplets and soon be killed. Lathrop stated that in his experience oil never had much larvicidal efficiency, but when eggs on apples were sprayed in the laboratory, the oil had an ovicidal efficiency amounting to 90–98 per cent. in some cases. Efficiency was much reduced in the case of eggs placed on apples already sprayed.

W. P. Flint stated that, with oil, efficiency equal to that obtained with lead arsenate had more nearly been approached in the field than in the laboratory. Larvae in the field, apart from being actually killed, were disturbed by the oil and often rolled off the apples. T. J. Headlee stated that in two years' experience protection over a 10-day period as

good as that obtained with lead arsenate was secured with white oil with a viscosity of 220, impregnated with pyrethrum extract. He also described various types of injury caused by oil. Apparent stimulation of foliage growth in the first year is followed by a material reduction in the amount of fruit set in the second year, and when the third season arrives the trees are almost barren. Another form of injury is chlorosis of foliage and small fruit stems resulting in the fall of a very considerable percentage of the fruit. A third type of injury appears as scorching of the foliage. The first type of injury was caused after 8 successive applications of 220 viscosity oil at the rate of ½ per cent., and the second within a week of the first application at the rate of 1 per cent. In 1931 a commercial oil with viscosity ranging from 80 to 85, combined with lead arsenate, gave excellent control of the first brood, without any appearance of injury. Flint stated that in his experience oil put on trees against the first brood of *C. pomonella* never failed to cause injury. The maximum amount of oil that could be used with safety in oil-lead arsenate combinations was 0·7 per cent. A great increase in efficiency was obtained by the addition of the oil.

Headlee stated that workers in Delaware had used fish-oil at the rate of 1 pt. to 100 gals. [lead arsenate] with absolutely no injury and about 10 per cent. increase in efficiency. He attributed the absence of injury to the small quantity of oil used and affirmed that both with animal and vegetable oils injury is produced by the use of more than a very small percentage. The question of the inclusion of a fungicide in the combination of oil and lead arsenate was also discussed.

Chandler (S. C.). **A Seven Year Study of the Plum Curculio in southern Illinois.**—*J. Econ. Ent.*, xxv, no. 1, pp. 101–106, 2 figs. Geneva, N.Y., February 1932.

An attempt has been made to follow the occurrence of *Conotrachelus nenuphar*, Hbst., on peach and to determine its seasonal periods of scarcity and abundance by means of studies carried out over a period of 7 years in southern Illinois. The isothermal line running through the locality in which the work was done also passes through several of the southern States, and it is possible that the occurrence of *C. nenuphar* may be similar all along it. Unsprayed and usually neglected peach orchards were selected each year for observation, and for three years comparisons were made with commercially sprayed orchards. The occurrence of the weevils was determined by jarring in the morning while they were still inactive [*cf. R.A.E.*, A, xx, 35], and from the data secured it is deduced that they first appear soon after the petals fall, increase in numbers, slowly at first, and reach their maximum in 3–8 weeks, depending mainly upon temperature. Their numbers may then decline steadily, even in unsprayed orchards under favourable conditions, until they are practically absent from the orchard at the end of the peach season, with only a moderate rise in July when most of the emergence from fallen peaches takes place. In seasons of abundant rainfall, however, the decline after the first maximum is only temporary, and large numbers occurred under these conditions in 1928 and 1929 at the end of June and throughout July. Petal fall and post-season sprays were shown to be valueless. Sprays are necessary at the time when the shucks fall and again 2–3 weeks later, and in seasons like 1928 and 1929 an application between 1st and 10th June is essential to eliminate the later infestation. These three sprays are generally considered an irreducible minimum in Illinois. The heavy infestation carried

over from 1929 resulted in a very severe early weevil attack on apples in 1930, when the peach crop failed entirely, but as the heat and drought of that year increased, the numbers of weevils decreased rapidly, and in 1931 the infestation was the lightest known for years. The preference of *C. nenuphar* for peach over apple was demonstrated in 1931, when 11 times as many weevils were jarred from 10 peach trees as from 10 apple trees, both unsprayed for two successive years. This would account for the comparative absence of weevil injury on apple in southern Illinois, where there is a large acreage of both apples and peaches, whereas in western Illinois, where there are very few peach orchards, *C. nenuphar* is often of more importance on apple than the codling moth [*Cydia pomonella*, L.].

HUTSON (R.). **The Control of the Cherry Case Bearer** (*Coleophora pruniella*) **by dormant and other Sprays.**—*J. Econ. Ent.*, xxv, no. 1, pp. 116–120, 7 refs. Geneva, N.Y., February 1932.

Larvae of *Coleophora pruniella*, Clem., which attack cherry in parts of Michigan, cherry and apple in Wisconsin, and apple in Quebec, injure the foliage of the trees during August and September just after they hatch, the fruit being sometimes attacked also, and again just as the buds are bursting in spring. During late September the young larvae move from leaves to twigs and small branches, where they secure their cases and remain till the buds burst in the following spring.

Tests in Michigan showed that the inclusion of 3 lb. lead arsenate in the after-harvest fungicidal spray, applied just as the eggs are hatching, gives a measurable decrease in the number of case-bearers migrating to winter quarters. Further investigation indicated that the larvae may be controlled by dormant sprays of oil or tar distillate without injury to the trees. The best results were secured with a 10 per cent. concentration, and any lowering of concentration appears to give reduced kill. A satisfactory degree of control was secured by the application of nicotine sulphate or derrisol, each in combination with lime-sulphur applied early in May 1931, when the temperature ranged between 60 and 70°F. This type of spray is recommended as an emergency measure, if dormant sprays have not been applied.

PETCH (C. E.). **A Reply to Burrill and Parris on the Use of Calcium Cyanide raw Linseed Oil Mixture for the Control of the Round-headed Apple-tree Borer.**—*J. Econ. Ent.*, xxv, no. 1, pp. 121–122, 2 refs. Geneva, N.Y., February 1932.

The use of a mixture of calcium cyanide and raw linseed oil for the control of the round-headed apple-tree borer [*Saperda candida*, F.] is defended against criticisms recently noticed [*R.A.E.*, A, xix, 547]. Examination of the trees said to be injured showed that where injury had occurred methods of application had been adopted that were neither advised nor implied. Instead of applying, as recommended, a paste composed of calcium cyanide and raw linseed oil to parts of the tree where castings were observed [xvi, 501], the mixture had been applied as a complete collar, and an attempt had been made to employ the material to prevent oviposition, a use for which it was never intended. It was admitted that injury almost always coincided with cutting of the bark before application, a practice that had never been contemplated, and where the bark had been left undisturbed no injury

had resulted. Furthermore many of the trees under discussion were already so riddled by the borer that they would have died in any event. The mixture has been used successfully for several years, even by some of the growers in the same valley, and its use is still recommended with confidence.

YETTER, jr. (W. P.) & STEINER (L. F.). **Efficiency of Bait Traps for the Oriental Fruit Moth as indicated by the Release and Capture of marked Adults.**—*J. Econ. Ent.*, xxv, no. 1, pp. 106–116, 1 ref. Geneva, N.Y., February 1932.

The following is taken mainly from the authors' abstract and conclusions: Extensive liberations in 1931 of marked individuals of *Cydia* (*Grapholitha*) *molesta*, Busck, within and at varying distances from large baited areas in Indiana and Georgia, proved that, owing to adult migration, the benefits derived from the use of baits were spread over much more than the immediate area baited. In Indiana flights of from 2,000 to 6,500 ft. over baited territory occurred following 12 of the 18 releases made there. In Georgia flights of more than a mile from an unbaited to baited peach orchards were recorded. Of 53 moths released in an unbaited orchard $\frac{1}{3}$ mile from the centre of a 37-acre trapped block, 26 per cent. were captured in the latter area. Of releases made within baited orchards, recoveries ranging from 16 to 85 per cent. were made. Little oviposition occurs within 48 hours of emergence, and moths flew as far as $\frac{2}{5}$ mile from unbaited to baited territory within this time. In Georgia moths recovered within 2 days contained an average of 141 eggs, whereas those recovered between 2 and 5 days after release averaged 126 eggs. Most recoveries were made within 5 days, but some as late as the 14th day. A mixture of baits in an area seemed more efficient than a single bait.

Rainfall, wind velocity and temperature during the hours of greatest moth activity directly affect the catch of moths and apparently affect egg deposition similarly. Wind direction appears to have little effect on the direction of flight, although long flights were most frequently made against winds of low velocity or in calm weather. In Indiana the most striking migrations occurred before the peach harvest, the females travelling further than the males. Baits in use at present cannot successfully compete against the odours emanating from the peach foliage and fruit. To be most attractive they must be placed in or very near the tree, as away from it they capture hardly any moths. Since the natural odours are so much more powerful than the baits, it is probable that, in the absence of the latter, migration of moths to more attractive peach or apple trees takes place as readily and over as great distances as in baited areas. If so, the tendency following the emergence of each brood will be to nullify any other artificial control efforts not conducted on a large scale or in isolated orchards.

MURPHY (D. F.) & PEET (C. H.). **Insecticidal Activity of Aliphatic Thiocyanates. I. Aphis.**—*J. Econ. Ent.*, xxv, no. 1, pp. 123–129, 4 refs. Geneva, N.Y., February 1932.

Extended research upon synthetic insecticides has disclosed that the insecticidal activity of certain groups persists in spite of important changes in the molecule to which these groups are attached. The most effective group hitherto brought to light is the thiocyanate group,

$-S-C\equiv N$. Alterations in the organic residue attached to this group produce definite changes in insecticidal activity, but all such changes are in degree rather than in kind. The action of certain aliphatic thiocyanates in very low concentrations is very rapid, and their effectiveness covers a wide range of insects, many of which have hitherto resisted control.

Laboratory tests have shown that a 0·0625 per cent. solution of an aliphatic thiocyanate, with the addition of 0·25 per cent. anhydrous soap (potassium stearate) killed an average of 98·58 per cent. of *Aphis rumicis*, L., and the same concentration of thiocyanate with the addition of 0·5 per cent. penetrol killed 99 per cent., as compared with 98·5 per cent. killed by nicotine, 1 : 1000, combined with 0·25 per cent. potassium stearate. Still more satisfactory results were obtained in field tests, an account of which is to be published later.

The insecticides of this series possess marked chemical stability. In their concentrated form they are not affected by heat, age or other storage conditions that result in the deterioration of such insecticides as pyrethrum or derris, and material that has been prepared for spraying does not lose its strength on standing. The diluted sprays show no physical alteration on standing for several days, and they spread and wet particularly well. No foliage injury was observed upon a wide variety of plants treated with the aliphatic thiocyanate tested in the experiments reported on, and in many instances where the plant was in blossom there was no injury even to the flower.

Drake (N. L.) & Spies (J. R.). **The Toxicity of certain Plant Extracts to Goldfish.**—*J. Econ. Ent.*, xxv, no. 1, pp. 129–133, 1 ref. Geneva, N.Y., February 1932.

An investigation, in which the goldfish, *Carassius auratus*, was used as a test organism, has been carried out to determine the toxicity of certain plant extracts on the assumption that any substance that might be useful as an insecticide would be highly toxic to fish. Tests on fish, which are far easier to carry out than those on insects, will merely serve as sorting experiments, the final decision as to insecticidal value being left to subsequent actual tests on insects.

The extracts tested showed a marked difference in toxicity, some producing no sign of distress in a 7-hour test period, whereas others killed the fish quickly. For the purpose of comparison a sample of derris root known to contain 1·7 per cent. rotenone was extracted and tested against the fish, and was found to cause death in an average of 92 minutes. Among the large number of plants tested, the only ones, acetone extracts of which were more toxic than derris, were *Manzanillo comun*, *Covilla* sp., *Urechites suberecta*, *Ceratiola ericoides*, and *Folha tingui*, which caused death in 42, 46, 48, 58 and 72 minutes respectively.

Crosby (C. R.). **Another Spider becomes a Greenhouse Pest.**—*J. Econ. Ent.*, xxv, no. 1, p. 134. Geneva, N.Y., February 1932.

Webbing of roses in a greenhouse, discovered on 10th November at Roslyn, N.Y., was found to be mainly due to *Eperigone tridentata*, Emerton, though single individuals of *Erigone autumnalis*, Emerton, and *Araneus cornutus*, Clerck, were also present.

Knowlton (G. F.). **The Colorado Potato Beetle in Utah.**—*J. Econ. Ent.*, xxv, no. 1, p. 134. Geneva, N.Y., February 1932.

Occurrences of *Leptinotarsa decemlineata*, Say, in Utah include a small infestation which was found and apparently eradicated at Morgan in 1928; one adult beetle which was collected at another locality in 1930; and an infestation of about 1,000 immature individuals at Ogden, discovered on 20th June 1931, which has apparently been eradicated.

Cutright (C. R.). **An Addition to the Biology of *Rhopalosiphum prunifoliae* (Fitch).**—*J. Econ. Ent.*, xxv, no. 1, p. 134. Geneva, N.Y., February 1932.

Examination over a six-week period of apple-trees in Ohio that had been banded with an adhesive soon after the leaves began to fall in autumn showed that numbers of immature sexual females of *Rhopalosiphum prunifoliae*, Fitch, carried to the ground on falling leaves, regained the trunk. On unbanded trees, they finally re-established themselves on the leaves.

Barrett (R. E.). **Notes on a new Potato Pest.**—*J. Econ. Ent.*, xxv, no. 1, p. 134. Geneva, N.Y., February 1932.

Gnorimoschema tuberosella, Busck, which was described from Peru as attacking potato [*R.A.E.*, A, xix, 367], was found in December 1930 boring in the stems of nightshade (*Solanum nigrum*) in southern California, where it is widely distributed. Breeding appears to be continuous in the field, as all stages were present whenever examination was made, and at least two parasites were found, one being a species of *Spilochalcis*.

Yothers (M.A.). **Chemically treated Bands destructive to Spider Mites and Woolly Aphis.**—*J. Econ. Ent.*, xxv, no. 1, p. 135. Geneva, N.Y., February 1932.

In the course of 5 years' tests of chemically treated bands for the control of *Cydia* (*Carpocapsa*) *pomonella*, L., on apple in the Wenatchee district of Washington, it was observed that bands made of corrugated paper or burlap treated with beta-naphthol dissolved in red engine oil placed round the tree-trunks in early summer, and allowed to remain there till the following spring, caught and killed large numbers of migrating forms of *Tetranychus telarius*, L., and *Eriosoma lanigerum*, Hausm., in late summer and autumn. If placed on the trees early in the spring before the migrating mites and Aphid nymphs ascend the trunks, they would probably afford some control of both.

Chamberlin (F. S.). **The apparent Incompatibility of Barium Fluosilicate and Nicotine Sulphate.**—*J. Econ. Ent.*, xxv, no. 1, p. 135. Geneva, N.Y., February 1932.

Severe scorching was observed in Florida two days after the application to shade-grown tobacco, simultaneously infested by *Frankliniella fusca*, Hinds, and the fleabeetles, *Epitrix parvula*, F., and *E. cucumeris*, Harr., of a spray of 1½ lb. barium fluosilicate, 12 oz. nicotine sulphate

and 50 U.S. gals. water applied at the rate of 100 U.S. gals. to the acre immediately after mixing. Later observations showed no appreciable increase in the damage. Nicotine sulphate solution was being used at the same time over a considerable acreage of tobacco without any apparent scorching, and barium fluosilicate was being applied in other fields at the rate of 4–8 lb. to the acre with only a slight trace of foliage injury. It was, however, moistened by dew and light showers on several occasions.

Jones (W. W.). **Mesquite injured by *Orthotylus translucens* Tucker in Arizona.**—*J. Econ. Ent.*, xxv, no. 1, p. 136. Geneva, N.Y., February 1932.

Injury to mesquite (*Prosopis glandulosa* and *P. velutina*) observed during the past 10 years in south-eastern Arizona is believed to be due to the Capsid, *Orthotylus translucens*, Tuck., which has been present in large numbers on the injured bushes. These fail to develop leaves and flowers at the proper time. Small green structures, apparently distorted leaves, are developed, but they dry up and fall off. The appearance of the bushes suggests the removal of the leaves by the feeding of insects as fast as they are developed. The affected bushes may be either scattered among normal bushes, or there may be fairly large areas in which practically no normal bushes exist. The first leaves developing on the affected bushes in late spring or early summer are distorted and yellowish in colour.

Thomas (W. A.). **Hibernation of 13-spotted Lady Beetle.**—*J. Econ. Ent.*, xxv, no. 1, p. 136. Geneva, N.Y., February 1932.

Hippodamia tredecimpunctata, L., has been observed for the past six years hibernating in steadily increasing numbers in the irregular pockets on the trunk of a cedar tree in North Carolina. At noon on 15th October 1931, when the temperature was 84°F. and the relative humidity 45 per cent., the beetles were observed moving in large numbers towards the trunk and lower branches of the cedar. By 2 p.m. the trunk was almost covered with the beetles, particularly on the south-eastern side, and within the next few days they entered the irregular pockets of the tree, concentrating on the same side, on which by 1st November they had assumed a quiescent state. The prevailing cold winter winds are from the north-west. No other types of trees in the immediate vicinity appeared to have any attraction for the beetles.

Snapp (O. I.) & Thomson (J. R.). **Comparative Effectiveness of Fall and Spring Applications of Paradichlorobenzene for Peach Borer Control.**—*J. Econ. Ent.*, xxv, no. 1, pp. 136–137. Geneva, N.Y., February 1932.

Better results are secured in the use of paradichlorobenzene crystals for the control of the peach borer [*Aegeria exitiosa*, Say] in Georgia from treatments made in the autumn at the end of the oviposition period than from those made in the spring when the larvae, being nearly full-grown, have had time to travel into the tree a considerable distance from the point at which the crystals are placed. In 1931, 100 per cent. mortality was observed 15 days after treatment on 14th October, as compared with 84·6 per cent. 6 weeks after treatment on 4th April.

THOMAS (C. A.). **The Potato Pin Worm,** *Gnorimoschema lycopersicella* **Busck, a new Pest in Pennsylvania.**—*J. Econ. Ent.*, xxv, no. 1, pp. 137–138. Geneva, N.Y., February 1932.

Phthorimaea (*Gnorimoschema*) *lycopersicella*, Busck, which has hitherto been known to occur only in Mexico, California and Hawaii [*R.A.E.*, A, xvi, 633–4], is recorded for the first time from Pennsylvania, where the larvae were found by the author to be causing injury to tomato in September 1931. Infestation amounting to 40–85 per cent. has been reported from California, where much injury occurred in 1930 [xix, 654]. The localised infestation in Pennsylvania was first observed in the winter of 1929–30, two years after receipt of shipments of celery and tomatos from California. The most serious injury occurred in greenhouses, but the damage spread to tomatos planted in the field, where injury was severe during the summer of 1930. *Solanum carolinense*, apparently a new food-plant for this species, was also attacked, and as this weed is abundant in the infested locality, eradication is likely to prove difficult. Infested houses were thoroughly cleaned out, and no tomatos grown in them during the winter of 1931–32. The larva of this moth can be distinguished from those of *P. glochinella*, Zell., and *P. operculella*, Zell., as it has, except when young, saddle-like purplish markings on the dorsum of the abdominal segments.

SHEPARD (H. H.) & LINDGREN (D. L.). **Ethylene Oxide-Liquid Carbon Dioxide Mixture in House Fumigation.**—*J. Econ. Ent.*, xxv, no. 1, pp. 138–139. Geneva, N.Y., February 1932.

The successful use of " carboxide," a liquid mixture of ethylene oxide and carbon dioxide in gas cylinders, for the control of carpet beetles [*Anthrenus* spp.] is recorded in October 1931 from Minneapolis, where in 1930 chloropicrin had been used with inadequate results and was found objectionable owing to the clinging odour of the gas. For a dwelling with an approximate space of 275,000 cu. ft., 58 cylinders of 55 lb. capacity were used, 10 of them being placed in the attics where the greatest infestation occurred and which were less airtight. One or two of the remaining cylinders were placed in each room on the lower floors, the attics and parts of the second and third floors being sealed from each other and from the lower rooms, in order to hold the gas as much as possible in the upper part of the building. It was found that the force of the escaping gas may overbalance the cylinders if they are not fixed in position. The house was left unoccupied for 48 hours, and when it was opened no odour of gas was apparent. Spots on the rugs from drippings from the cylinders were easily removed with water. No living beetles have been found in the house since fumigation.

MCGREGOR (E. A.). **A peculiar Spotting of Oranges in Central California.**—*J. Econ. Ent.*, xxv, no. 1, pp. 139–140. Geneva, N.Y., February 1932.

In order to test the validity of the theory that a proportion of the spotting observed on the rind of oranges and certain other varieties of *Citrus* in central California is due to leafhoppers, numbers of *Erythroneura comes*, Say, were confined with oranges under cloth bags, and other oranges were bagged in the absence of leafhoppers. All navel oranges with confined hoppers soon developed typical rind spots, an average of 4 spots being present on each fruit. Similarly exposed Valencia

oranges showed an average of 0·75 spots to each fruit and protected oranges developed no new spots. Tests with purely mechanical abrasion showed that puncturing oil cells with a very fine needle point led to more or less typical rind spots. No spots developed after the confinement of citrus thrips [*Scirtothrips citri*, Moult.] with bagged unblemished oranges, but it is possible that ovipositing thrips may at times puncture oil cells and cause a limited amount of spotting.

Clark (C. A.). **A commercial Use for a destructive Pest.**—*J. Econ. Ent.*, xxv, no. 1, p. 137. Geneva, N.Y., February 1932.

Cocoons of a bagworm (*Thyridopteryx*) are now used in Japan for making various articles such as shoes, handbags and belts. The insects are collected when full-grown, the larvae are removed and the cases slit and cleaned. Each case furnishes a piece of about 1 inch square and a number of these are stitched together. As the cases are very tough, the articles made from them should be durable. This idea is recommended for adoption in the United States, where bagworms are both abundant and destructive, as a simultaneous means of providing employment and reducing the numbers of a harmful insect.

Sazama (R. F.). **An improved Oviposition Cage for the Codling Moth.**—*J. Econ. Ent.*, xxv, no. 1, pp. 140–141. Geneva, N.Y., February 1932.

A new type of oviposition cage, developed in Indiana in connection with mass rearing of newly-hatched larvae of the codling moth [*Cydia pomonella*, L.], is described. The bottom is cut out of a cylindrical coffee tin 6 ins. high by 4 ins. diameter, a piece of cellophane is placed on the top and the cover forced on over it. The tin is then inverted and lined with cellophane paper which is held in place by 4–5 paper clips around the open top, over which a single piece of cheesecloth is stretched by means of a rubber band.

Data of oviposition tests, in which heavy wax paper and cellophane and crepe paper of various colours were compared as linings, showed red cellophane to be the most promising, as it is efficient, cheap and easily handled. The crepe paper shrinks in the high humidity of the incubator. Greater numbers of eggs per moth were produced when 200 moths were confined in each cage than when smaller numbers of moths were used.

Marcovitch (S.). **The Residue Problem and Fluorine Compounds.**—*J. Econ. Ent.*, xxv, no. 1, pp. 141–142, 1 ref. Geneva, N.Y., February 1932.

In view of the increasing prevalence of the belief that fluorine compounds are possibly as objectionable from the standpoint of health as lead arsenate when used as insecticides, the literature relating to the chronic and acute toxicity of these compounds and their effect on the human system is discussed. A comparative list is given of the acute toxicities to mammals determined for lead and calcium arsenates, sodium and barium fluosilicates, sodium fluoride and cryolite, indicating that the minimum lethal dose for fluorine compounds is somewhat less than for arsenicals. In regard to chronic toxicities, however, which are of primary importance, the fluorine compounds are at least 100,000 times safer than lead arsenate and possess a marginal safety factor over the average spray residue content of 75.

Shepard (H. H.) & Campbell (F. L.). **The relative Toxicity of Rotenone and some related Compounds as Stomach Insecticides.**—*J. Econ. Ent.*, xxv, no. 1, pp. 142–144. Geneva, N.Y., February 1932.

Tests by means of the leaf sandwich method [*R.A.E.*, A, xviii, 311, 481] were carried out with fourth-instar larvae of *Bombyx mori*, L., to determine the relative toxicity as stomach poisons of 4 pure compounds extracted from certain fish-poison plants and 5 derivatives of rotenone.

The following were found to be the median lethal doses of the four most toxic compounds : rotenone, approximately ·003 mg. ; dihydro-rotenone, not more than 0·01 mg. ; deguelin, between 0·01 and 0·012 mg. ; and tephrosin, between 0·03 and 0·06 mg. ; as compared with acid lead arsenate, approximately 0·09 mg. per gram of body weight. Toxicarol, derritol, rotenol, dihydro-rotenone and tubaic acid could not be arranged in order of toxicity as none of the insects died from the doses given ; they are either non-toxic, or of so low an order of toxicity as to have no possibilities for practical use. Wide differences in the effectiveness of rotenone noted in recent tests by other workers suggest that the degree of toxicity may depend on the physiological characteristics of the species of insect and its food. Rotenone and related compounds are not repellent to *B. mori*, which may therefore take many times the median lethal dose. The action of the compounds is so slow and mild that the larvae neither regurgitate nor undergo spasms as is often the case in poisoning by arsenicals and fluorine compounds.

Of the 5 derivatives of rotenone, only dihydro-rotenone approached the toxicity of rotenone. The decrease in toxicity of rotenone when allowed to stand in solution in certain organic solvents [xix, 357] is probably due to its spontaneous oxidation to dihydro-rotenone [xix, 634]. The results so far obtained indicate that derivatives and degradation products of rotenone are likely to be less toxic than rotenone itself.

Collins (C. W.). **The Beech Scale (*Cryptococcus fagi* Bärenspr.), recently discovered in New England.**—*J. Econ. Ent.*, xxv, no. 1, pp. 144–145. Geneva, N.Y., February 1932.

A brief account is given of the finding of *Cryptococcus fagi*, Bär., in the United States and of experiments indicating the value of a dormant oil spray for its control [*R.A.E.*, A, xx, 282]. It attacks American beech (*Fagus grandifolia*) and the European *F. sylvatica* with equal severity, but a preliminary survey indicates that infestation at present occurs over a limited area in Maine and Massachusetts, where, in the latter State at least, native beech is not abundant. A natural barrier exists between the present known infested areas in Massachusetts and that of the beech forests in western Massachusetts, northern New Hampshire and Maine.

Friend (R. B.) & Turner (N.). **The Mexican Bean Beetle in Connecticut.**—*Bull. Conn. Agric. Expt. Sta.*, no. 332, pp. 72–108, 14 figs., 35 refs. New Haven, Conn., December 1931. [Recd. March 1932.]

A detailed account is given on the bionomics and control of *Epilachna corrupta*, Muls. (Mexican bean beetle), largely taken from the literature, with special reference to Connecticut, where it has been

present since 1929. Observations on its life-history in that State in 1931 showed that the overwintered adults begin to appear late in May and early in June. Adults of the first generation occur from mid-July until the end of August, and those of the second from early September until they are forced to enter hibernation owing to frost. A partial third generation may also occur. The life-cycle from egg to adult lasts 33–39 days and the larval period 19–22.

Experiments showed that a spray containing magnesium arsenate and calcium caseinate, or a dust of 1 part magnesium arsenate or barium fluosilicate and 5 parts lime, applied 2–5 times as required and directed on to the lower surface of the leaves gives good control and does not scorch the foliage. These insecticides should not be used after the pods are half-grown unless the beans are washed before marketing.

THOMAS (C. A.). **Mushroom Insects. Their Biology and Control.**— *Bull. Pennsylvania Agric. Expt. Sta.*, no. 270, 42 pp., 6 pls., 53 refs. State College, Pa., October 1931. [Recd. March 1932.]

The cultivation of mushrooms has developed rapidly in Pennsylvania during the last 20 years, and an account is given of their principal insect pests, with a key to the injuries they cause. General preventive measures include the removal to a distance and destruction of all discarded mushrooms and all old manure. After the crop is over, the house should be fumigated with steam, sulphur or hydrocyanic acid gas, and shortly before again being filled, it should be fumigated with 5 lb. of sulphur to each 1,000 cu. ft., and if possible screened at doors and ventilators with wire gauze of at least 30-mesh. Almost all the pests found in the manure heap enter it after it has been placed on the ground, and in about 10 days springtails and mites are quite abundant in it. As practically all the insects and mites occur in the top six inches, where it is moist and cooler than below, some insecticide applied to this upper layer might kill them before the manure is brought into the mushroom house. The ground should be thoroughly cleaned before the manure heap is made and some volatile insecticide used on it. As soon as it is placed in the house, the manure begins to heat, and as many insects driven out of the manure by heat may survive after reaching the lower temperatures on the surface, some fumigant, such as calcium cyanide (1 lb. to each 1,000 cu. ft. of space) should be used while the beds are at their hottest, though it does not penetrate the manure more than 1 inch. The fumes from $1\frac{1}{2}$ to 2 lb. of burning flowers of sulphur to each 1,000 cu. ft. of space are a cheap and fairly effective fumigant, and penetrate further into the manure, but sulphur should never be used after the spawn is planted or even when there is spawn in adjacent houses. Sterilisation by steam, using perforated pipes in the filling aisle, is sometimes practised, but if the temperature is allowed to go too high, heavy moulds result. Insects and mites develop most rapidly at temperatures of 60°F. or more, and good results have been reported by keeping the temperature of the houses at about 45–50°F. during the crop season ; although this retards the growth of the mycelium and mushrooms, it also retards the development of fly larvae, which do not feed so rapidly.

The most widespread and destructive mushroom pests are probably Mycetophilids, of which the most important in Pennsylvania are *Sciara coprophila*, Lint., *S. multiseta*, Felt, *S. agraria*, Felt, and *S.* (*Neosciara*) *pauciseta*, Felt. These differ very little in their appearance or biology,

The fly oviposits on the manure in the houses, or, when the mycelium is growing and the beds are " cased " (by covering them with ½–1 in. of soil), on the casing soil, at the base of the mushroom stem and on the stem, gills or cap. The eggs hatch in 4–6 days, though there is much variation in development of this and other stages. The larvae feed on the mycelium or bore into the tissues of the mushrooms, which may be entirely honeycombed within. The larval stage lasts 10–14 days. After the watering of the beds (a few weeks after they are cased), the larvae sometimes appear on the casing soil in immense numbers. Full-grown larvae crawl down to the soil or manure, where they pupate, usually in thin silken cocoons. The pupal stage lasts 4–7 days. The life-cycle from oviposition to adult emergence requires 18–23 days at 63–70°F. These flies are also indirectly injurious by carrying the spores of various moulds and the hypopi of Tyroglyphid mites. Natural enemies are not numerous ; *Calliceras amplus*, Ashm., has been reared from *S. pauciseta*, and the Nematode, *Tetradonema plicans*, Cobb, parasitises the larva of *S. coprophila* in the Mid-west, but has not been observed in Pennsylvania. Larvae and adults of Staphylinid beetles feed occasionally on various stages of the flies, and under warm, moist conditions the latter are sometimes attacked by a fungus. As the flies are positively phototropic, a number of light traps have been devised, of which the most successful consists of a flat pan containing kerosene suspended a few inches below an electric light on the ceiling. Single panes of glass let into the doors or end walls of the house, with sticky paper tacked at the bottom and sides, also trap many flies. Several fumigants have been employed. Calcium cyanide, using not more than 1½–2 oz. to each 1,000 cu. ft. of space, kills a high percentage of flies after several hours' exposure without injury to the mycelium or mushrooms ; the temperature should be at least 60°F. during the process ; the humidity should be low and the marketable mushrooms should be picked before fumigation. Fumigation should be repeated as more flies emerge. Tobacco fumigants kill a fair number of the flies but have little effect on the larvae in the beds. A number of commercial dusts of which the active ingredient is pyrethrum, or pyrethrum and tobacco, have been used under the same conditions, using 2½ to 3 oz. of dust to each 1,000 cu. ft. of space. Against larvae on the casing soil various substances have been used, such as pyrethrum dusts, hydrated lime and other forms of lime, free nicotine sprays, etc. ; some of these have been quite effective.

Several species of Phorids including *Aphiochaeta albidihalteris*, Felt, and *A. pygmaea*, Zett., have been found in mushroom houses. They occur in immense numbers about the manure heaps in warm weather, entering the houses in the manure or as adults through doors and ventilators. The larvae hatch from eggs laid on the manure or casing soil and feed on the spawn for a week or more. The life-cycle apparently takes longer than that of the Mycetophilids. Forcing the spawn growth as soon as pupation begins should allow the mycelium to spread through the manure before the next generation appears and thus ensure a crop. The Phorid larvae may also infest the stems and caps, the latter sometimes being entirely honeycombed by them. The methods of control are much the same as for Mycetophilids, but the Phorids are somewhat more resistant to fumigants so that the dosage may have to be increased.

Collembola, especially *Achorutes armatus*, Nic., and, to a less extent, *Lepidocyrtus cyaneus*, Tull., sometimes appear in enormous numbers

and may be major pests of mushrooms, entering the manure heaps from adjacent soil and so being carried into the houses. The eggs are deposited in small groups on or in the manure, on the casing soil or at the base of mushrooms, and feeding continues from hatching until death, the springtails eating through the strands of mycelium and entirely destroying it, and later devouring portions of the caps and stems. Certain Gamasid and Bdellid mites, the Anthocorid, *Orius* (*Triphleps*) *insidiosus*, Say, various Staphylinids, and the Anthicid, *Tomoderus constrictus*, Say, feed on mushroom springtails but are seldom of any real assistance in control. Treatment of the manure heap as described above will largely prevent the introduction of springtails. In the house, the temperature in the upper beds is high enough to kill them, but if any survive in the bottom beds, they eventually reinfest the upper ones. An application of petrol or kerosene to the posts or encircling the base of each post with a dust of 3 per cent. free nicotine and lime, which is effective for 3 days, will prevent them from ascending. Paradichlorobenzene is both attractive and toxic ; a practical method of application is to lay cheap muslin over the manure, scatter the fumigant over this and spread several layers of newspaper above. After 48 hours most of the springtails are killed in the upper four inches of manure, but this substance is at present only recommended in cases of severe infestation of the bottom beds. After the beds are cased and before the mushrooms appear, nicotine-lime dust may be applied to the casing soil, or a light fumigation with $2\frac{1}{2}$ oz. calcium cyanide to each 1,000 cu. ft. will kill many springtails. As damp conditions encourage Collembola, regulation of the moisture of the casing soil and bed will assist in control, and lime dusted lightly on the casing soil during heavy infestations has some value. The springtails can breed at temperatures considerably below 50°F.

The chief mites causing injury to mushrooms are *Tyroglyphus lintneri*, Osb., and *Linopodes motatorius*, L. (*antennaepes*, Banks) and occasionally *Rhizoglyphus phylloxerae*, Riley. *T. lintneri* sometimes appears in large numbers when the manure in newly-filled beds reaches its maximum heat of 140–150°F., and later the mites feed on the mycelium or mushrooms. The eggs are deposited on the manure, the soil, or in or on the mushroom. The mites are preyed upon by Gamasids, which may sometimes keep them in check, and the larva of a small Cecidomyiid also feeds on them, but is not common. Fumigation as described above is a valuable preventive measure, and paradichlorobenzene, as used against springtails, is also successful, but must be left on the beds for several days ; a small section of a bed should be tried to determine the effect on mites and mushrooms and the time required. Nicotine and pyrethrum dusts are useless against Tyroglyphids ; oily fly sprays will kill them by contact but injure the mushrooms. As these mites are susceptible to drying, the bed surface might be allowed to dry for a while, and the house should be thoroughly dried while empty, and fumigated with sulphur or steamed before filling up again. All infested mushrooms should be gathered as often as possible and destroyed. The chief injury from *Linopodes* [*cf. R.A.E.*, A, xviii, 684] is to the base of the stems, which are frequently chewed off at the bottom so that only one or two strands of mycelium remain.

Minor or occasional pests of mushrooms include the larvae of the Noctuid, *Metalectra quadrisignata*, Wlk., against which only hand-collection is necessary, and Cecidomyiids, which should be controlled by the measures used against Mycetophilids and Phorids.

SHELFORD (V. E.). **An experimental and observational Study of the Chinch Bug in Relation to Climate and Weather.**—*Bull. Illinois Nat. Hist. Survey*, xix, art. 6, pp. 488–547, 37 figs., 27 refs. Urbana, Ill., January 1932.

Detailed investigations reported in this paper endeavour to determine the association between the abundance of the chinch bug (*Blissus leucopterus*, Say) and variations in rainfall and temperature in particular years or series of years. The experiments and observations include a study of length of instars and of the life-history in relation to conditions of temperature, humidity, light, etc. ; a study of the success of cultures under conditions similar to those under which the instars were studied ; and a study of records of abundance, migration, rise and decline of the pest in Illinois since 1840. The results are shown in a series of tables and charts. There are certain immeasurable factors connected with food, soil, presence of other insects, etc., which so far overshadowed experimental differences in temperature, humidity and light as partly to vitiate the results of experiments, but the results of the present study are summarised as follows :—Individual variation in the lengths of instars and life-histories is very great, probably on account of the sensitivity of the bugs. Low humidity affects the first instar strikingly and each succeeding stage to a less degree. The relations of the rate of development to temperature and humidity are expressible in developmental units, and for each stage an equal-velocity chart is presented, similar to those used by the author in his study of the codling moth [*R.A.E.*, A, xv, 532]. The success of the bugs in a long series of cultures shows that their vigour varies from year to year. They were very strong in 1919 and 1925, producing 3 or 4 generations in each of these years. They were weakest in 1921. This does not, however, correspond with the severest outbreaks of the bugs in the State. It does not indicate the possible importance of internal factors not directly correlated with the immediate surrounding conditions but determined earlier. It is necessary to consider lack of balance in the bugs themselves as well as lack of balance in the system of nature of which they are a part. In the early history of the outbreaks in Illinois there was a striking correlation between human death rate and chinch bug damage. With better developed agriculture and improved sanitary conditions, this relation has become less striking.

VAN ZWALUWENBURG (R. H.). **Summary of Investigations of the Soil Fauna of Sugar Cane Fields in Hawaii.**—*Proc. 3rd Cong. Int. Soc. Sug. Cane Technol. Soerabaia, 1929*, pp. 216–225. Soerabaia, 1930. [Recd. March 1932.]

This paper contains an account of investigations on the soil fauna of sugar-cane fields in Hawaii, and the first half deals with studies to determine the species of macrofauna (which term is used to include all forms of animal life, except Nematodes, up to the size of root grubs) that attack the roots and might therefore be concerned in the growth failure of sugar-cane. All field studies were confined to the top 9 inches of soil. In soil in which cane was growing, the macrofauna averaged over 1,600 to each square foot of surface, and 58 per cent. were found to be potentially injurious to the roots.

Apart from mites and other forms the injuriousness of which is problematical, *Isotomodes* spp. [*R.A.E.*, A, xv, 322 ; xvi, 449] were the most abundant of those found to feed to some extent on the tender

portions of cane roots. They comprise 48 per cent. of the total macrofauna and average 750 to each square foot of surface. They are most numerous in the top 1–5 inches of soil, or somewhat deeper during periods of drought. The damage caused by these Collembola produced a marked reduction in the aerial growth of the plants, which in the presence of the fungus, *Pythium*, was even more pronounced. These observations are substantiated by similar work in Louisiana [xviii, 168, 678]. Experiments showed that in a soil composed of a mixture of soil and volcanic ash 28·8 pits were found to each inch of root, whereas in one composed of layers of soil-ash and compost, soil and ash, and pure compost only 0·6 pits were found to each inch of root, the insects apparently concentrating in the layer of compost.

Japyx sp. was found at an average rate of 7 to each square foot of surface, but it is sometimes considerably more abundant in plantation fields. The damage it does to cane roots takes the form of ragged feeding, rather than of sharply defined pitting. This Thysanuran is most abundant between 5 and 9 inches below the surface. Other representatives of the macrofauna are discussed, and it is concluded that the injury they cause as a whole to the roots of cane is of minor importance.

HOLLOWAY (T. E.). **Sugar Cane Insects of North America and the West Indies (excluding Cuba). A Bibliography and List of known Parasites, Insect Predators and Diseases.**—*Proc. 3rd Cong. Int. Soc. Sug. Cane Technol. Soerabaia, 1929*, pp. 184–216. Soerabaia, 1930. [Recd. March 1932.]

A list is given of references to the literature of the last 50 years on the species of insects of any importance infesting sugar-cane in North America and the West Indies, with the exception of Cuba, with the addition of various previously unpublished notes. The parasites, predators and diseases attacking them are also recorded.

WILLE (J.). **Der Coca-Strauch Perús und seine Schädlinge.** [The Coca Shrub of Peru and its Pests.]—*Tropenpflanzer*, xxxv, nos. 1–2, pp. 9–25, 47–64, 22 figs., 12 refs. Berlin, January–February 1932.

A more detailed account is given of the insects injuring coca (*Erythroxylon coca*) in Peru than one already noticed [*R.A.E.*, A, xix, 458]. The leaf-cutting ant, *Acromyrmex hispidus*, Santschi, is successfully controlled by flooding the nests and keeping them under water for several days or by fumigation with white arsenic [*cf.* xviii, 39]. The Lymantriid, *Eloria noyesi*, Schaus, of which coca is the chief food-plant and the only one on which eggs are laid, appears to occur between the eastern slope of the Peruvian Andes and southern Venezuela. All its stages are described. The moths in captivity lived for 9 days. Oviposition usually occurs at night, and in the field the eggs hatched in 5–6 days at 28°C. [82·4°F.] and 7–8 days at 20°C. [68°F.]. The pupal stage lasted about 10 days and was passed in cocoons among dense foliage of coca, coffee, etc. The Tineid, *Eucleodora cocae*, Busck [xix, 367], has been observed on coca in various areas in Peru since 1926. Like *E. noyesi* it has probably migrated from wild coca plants. All its stages are described. The adults fly between 6 and 8 p.m., and shelter by day on the lower surface of the coca leaves. Observed egg-masses

contained 67, 43, and 29 eggs. There seem to be 5 larval instars, each lasting 5–6 days. The young larvae feed gregariously, skeletonising the leaves, and the older ones protect themselves against loss of moisture by spinning shelters. The pupal stage occurs on the leaves and lasts 8–9 days.

VANDENBERG (S. R.). **Report of the Entomologist.**—*Rep. Guam Agric. Expt. Sta. 1930*, pp. 23–25. Washington, D.C., September 1931. [Recd. March 1932.]

Though the work of breeding *Pimpla* (*Exeristes*) *roborator*, F., for liberation against *Pyrausta nubilalis*, Hb. (European corn borer) in Guam was continued during 1930, there is doubt as to its value, no conclusive evidence of the influence of the parasite in the field having been observed [*cf. R.A.E.*, A, xix, 576]. The introduction of the Tachinid, *Ceromasia* (*Masicera*) *senilis*, Mg., has therefore been suggested. The larvae of a Tortricid apparently allied to the codling moth [*Cydia pomonella*, L.] were found to be suitable for use as laboratory hosts of *Pimpla* and occur at a time when corn-borer larvae are scarce.

An infestation by white grubs (*Lachnosterna* sp.) of the roots and stems of approximately 1 per cent. of a pineapple crop was controlled by one application of carbon bisulphide on pieces of cotton (3 to each plant) set beneath the soil close to the stems. The plants resumed growth, even in cases where the central leaves had rotted at the base.

TOLLENAAR (D.). **Jaarverslag 1 Mei 1930–30 April 1931.** [Annual Report of the Vorstenland Tobacco Experiment Station for May 1930–April 1931.]—*Meded. Proefst. vorstenl. Tab.*, no. 71, 93 pp. Klaten (Java), 1931. [Recd. February 1932.]

Dr. T. Thung contributes the phytopathological observations (pp. 28–46).

The tobacco aphis, *Myzus persicae*, Sulz., spread considerably owing to delay in combating it in the preceding year. In small plots it can be controlled by repeated spraying with 0·5 per cent. nicotine. Mites (*Cosmoglyphus krameri*, Berlese) received from Holland, where they had been found in baled tobacco, were placed on fermented tobacco but died without causing injury.

FLETCHER (T. B.). **Report of the Imperial Entomologist.**—*Sci. Rep. Imp. Inst. Agric. Res. Pusa, 1930–31*, pp. 87–92. Calcutta, 1932.

Sugar-cane pests under observation in 1930–31 included *Aphis sacchari*, Zehnt., which was attacked by *Scymnus nubilus*, Muls., though it did not reduce its numbers to any great extent ; *Trionymus* (*Pseudococcus*) *sacchari*, Ckll., which was abundant on ratoon canes, the females being heavily parasitised during May and June ; and *Neomaskellia bergi*, Sign., which was especially numerous in November and January. The rate of parasitism of eggs of *Pyrilla pusana*, Dist., *P. aberrans*, Kby., and *P. perpusilla*, Wlk., reaches a maximum in October, but drops with the onset of the cold weather. Infestation from season to season is carried over by nymphs that hatch from eggs that have escaped parasitism in December, and are able to maintain themselves on oats and other grasses until the new sugar-cane begins to grow. A Coniopterygid was observed attacking the egg-masses. Investigations

showed that of 5,817 plants, 2,451 were killed by *Scirpophaga nivella*, F., *Diatraea venosata*, Wlk., *Argyria sticticraspis*, Hmps., *Chilo zonellus*, Swinh., and termites, the percentage of infestation by each pest varying according to the variety of cane. It was found that planting cane to a depth of 6 ins. as against 3 ins. is of some value in avoiding infestation by moth borers, probably because shallower plantings sprout earlier and receive a larger proportion of the eggs. Systematic collection of the eggs and adults of *Scirpophaga nivella* is apparently of value in preventing damage by this pest. The eggs were heavily parasitised during March and April, and over 1,600 Chalcidoid parasites were bred and liberated in the field. *Emmalocera depressella*, Swinh., was very active from the beginning of May to mid-June, a period when other borers are rendered almost inactive by the hot weather. Later in June it was found to be parasitised by a Braconid.

Other pests included *Laphygma exigua*, Hb., on lucerne; *Prodenia litura*, F., and *Diacrisia obliqua*, Wlk., on mangels, the former also attacking cauliflower seedlings; *Indarbela* sp. on *Zizyphus jujuba*, guava, etc.; *Eupterote undata*, Blanch., which was particularly abundant on *Tecoma grandiflora*; *Pulvinaria psidii*, Mask., on guava; and *Pseudococcus corymbatus*, Green, on bunches of grapes.

The Cerambycid, *Coloborhombus* (*Nothopeus*) *hemipterus*, Ol., was observed damaging guava in the Bhagalpur district, and the larvae were destroyed by injecting carbon bisulphide into the burrows. The Prionid, *Dorysthenes* (*Lophosternus*) *hügeli*, Redt., was sent for identification from Kumaon, where the larvae bore in apple trees and are annually responsible for the death of about $2\frac{1}{2}$ per cent. The Eurytomid infesting apricots mentioned in a previous report [*R.A.E.*, A, xviii, 443] has been identified as *Eurytoma samsonovi*, Vass. It occurs in the Punjab and the North-west Frontier Province. Dhupa nuts (*Vateria indica*) received from Mangalore (Madras) were found to be seriously infested by the larvae of a weevil, probably an undescribed species of *Calandra*.

Bishop (H. J.). **Biological Control of the Citrus Mealy Bug.**—*Fmg. S. Afr.*, 1931, reprint no. 64, 7 pp., 3 figs. Pretoria, 1931. [Recd. March 1932.]

Notes are given on the mass breeding of the Coccinellid, *Cryptolaemus montrouzieri*, Muls., for the control of *Pseudococcus citri*, Risso, on *Citrus* in Cape Province, potato sprouts artificially infested with the mealybug being used for rearing the beetles. The technique employed is based on that of Smith & Armitage, which was described in detail in a paper already noticed briefly [*R.A.E.*, A, xix, 494]. The breeding of the Coccinellids should begin in August or early September, in order that an ample supply may be ready when the Coccids first appear on the young fruit early in January. In this work breeding was begun at the end of June 1929 with 20 beetles, and by mid-May 1930, 23,470 individuals had been reared. In spring the egg-stage lasted 8–10 days, the larval 20–28, and the pupal 14–20; in the summer the total life-cycle occupied 32–36 days. The liberations were made from early January onwards, and in every instance good control of the mealybug was obtained. Experiments show that the beetles fail to survive the winter under natural conditions, and artificial propagation each year is therefore necessary. Ants observed fostering the mealybug in the field were *Anoplolepis* (*Plagiolepis*) *custodiens*, Fr. Smith, *Tetramorium sericeiventre*, Emery, and *Iridomyrmex humilis*, Mayr.

Vayssière (P.). **Sur les recherches scientifiques en vue de la protection des cultures coloniales contre leurs parasites.**—*Actes Ass. Colon. Sci.*, viii, no. 80, pp. 29–36 [in] *Rev. Bot. appl.*, xii, no. 126. Paris, February 1932.

The author quotes several examples of heavy annual losses to crops in the French Colonies as a result of insect infestation. He deplores the present inadequacy of effort to deal with the situation in them and contrasts work done in other countries, referring in this connection to a recent summary on the organisation of insect control in the British Empire [*R.A.E.*, A, xviii, 419].

Bellio (G.). **La fumigazione con acido cianidrico di limoni in casse.** [Fumigation with Hydrocyanic Acid Gas of Lemons packed in Cases.]—*Citrus*, (2) xviii, no. 1, reprint 12 pp., 9 figs. Messina [1932].

An account is given of fumigation experiments with hydrocyanic acid gas in Sicily against Coccids on harvested lemons, undertaken as a result of the regulation of 12th March 1931 of the Argentine government ordering the destruction of all fruits found on importation to harbour noxious insects or fungi. In an air-tight fumigation chamber a dosage of 1 oz. HCN per 100 cu. ft. killed all scales on lemons wrapped in paper and packed in closed cases. In another test, cases of lemons wrapped in the special paper required by the Argentine regulations were stacked and fumigated in the open under a cover of close but not impermeable fabric. The method of stacking the cases so as to leave corridors in which the fumigant was released is described. It was found that fumigation for 50–60 minutes with 35 oz. HCN per 1,000 cu. ft., which, allowing for losses due to the use of jars placed in various positions in the spaces, corresponded to 70 oz. of 96–98 per cent. sodium cyanide, was absolutely effective against all the scales found in Sicily, including *Aspidiotus hederae*, Vall., *Chrysomphalus dictyospermi*, Morg., *Lepidosaphes pinnaeformis*, Bch., etc., This method of fumigation has now been carried on for several months. The treatment accelerates the ripening of the lemons.

Werder (A. O.). **Beitrag zur Kenntnis der Aphiden-Fauna von Basel und Umgebung.** [A Contribution to the Knowledge of the Aphid Fauna of Basel and Environs.]—*Verh. naturf. Ges. Basel*, xlii (1930–31), pp. 1–98, 34 figs., 141 refs. Basel, 1932.

A list of the Aphids of Switzerland is given. Material collected in and near Basel in 1927–29 comprised 111 species of which 79 are new to the country. Notes are given on their food-plants, and some natural enemies and ants associated with various species are recorded, with details of unknown stages or little known species. *Phyllaphis fagi*, L., hitherto only recorded from beech, has been observed on a fern, *Athyrium filix femina*, accompanied by morphological changes evidently due to the new food-plant. This phenomenon may throw some light on the disputed classification of the Aphids allied to *Aphis fabae*, Scop. As morphological changes are possible from one single abnormal change of food-plant, the characters of the so-called biological species of the *fabae* group require a thorough experimental and statistical revision.

Franssen (C.). **Nogmaals de " zwarte bladluizen."** [A further Note on the " black Aphids."]—*Ent. Ber.*, viii, no. 182, pp. 306–309. Amsterdam, 1st November 1931. [Recd. February 1932].

The author points out that the morphological changes recorded in examples of *Phyllaphis fagi*, L., from an abnormal food-plant [see preceding abstract] are limited to less chitinisation, and are not comparable with the characters used by him in defining the species allied to *Aphis fabae*, Scop. [*R.A.E.*, A, xv, 464]. These are enumerated.

Oudemans (A. C.). **Acarologische Aanteekeningen cx, cxii.** [Acarological Notes, cx, cxii.]—*Ent. Ber.*, viii, nos. 181, 183, pp. 289–296, 350–364. Amsterdam, 1st September 1931, 1st January 1932.

New mites described include *Metatetranychus mali*, on apple in Bremen; *Tetranychus manihoti*, on cassava (*Manihot utilissima*); and *Tydeus hyacinthi*, infesting hyacinth bulbs.

Oudemans (J. T.). *Epiblema proximana* **H. S., een nieuwe vijand onzer Naaldboomen.** [*E. proximana*, a new Pest of Conifers in Holland.] —*Ent. Ber.*, viii, no. 183, pp. 342–346. Amsterdam, 1st January 1932.

The Tortricid, *Epiblema proximana*, H.-S., which is rather rare in Holland, infested *Abies grandis* to some extent in 1930, and in 1931 increased and caused decided damage, which though limited to the lower branches sometimes affected nearly all their needles. The mature larvae enter the ground-litter in autumn and pupate there in spring, the adults emerging in May. Other species of *Abies* and *Pseudotsuga taxifolia* (*douglasi*) were attacked to a less degree, but the latter does not appear to be a favoured food-plant.

Gleisberg (W.) & Mentzel (F.). **Zur Methode der Raupenleimprüfungen im Freiland und Laboratorium.** [On the Method of testing Banding Adhesives in the Field and in the Laboratory.]—*NachrBl. deuts. PflSchutzDienst*, xii, nos. 1–2, pp. 4–5, 10–13, 4 figs. Berlin, January-February 1932.

Part of this paper is a condensed account of experiments already noticed [*R.A.E.*, A, xx, 9]. In addition an apparatus is described in which two unequal weights are suspended from a pulley. The lighter weight is allowed to rest on the adhesive to be tested and by the release of a brake the heavier one is allowed to pull on it. The time that elapses before it parts from the adhesive is the measure of the quality of the latter.

Robbins (J. C.). **On a Pine Sawfly** (*Diprion sertifer*, **Fourc.) and its Parasites.**—*Trans. Suffolk Nat. Soc.*, i, pt. iii, pp. 177–179. Monks' Soham, 1931. [Recd. March 1932.]

An outbreak of *Diprion sertifer*, Geoff., occurred on a plantation of young pines (*Pinus sylvestris*) in Suffolk during 1926–28. Many of the larvae were killed by a disease, the symptoms of which are described, and they were less abundant in 1929 and 1930. During 1929, some larvae in

the insectary also died as a result of this disease, but large numbers spun cocoons, which were nearly all completed by the end of June. Most of the cocoons gave rise to adults between 1st September and mid-November, and a few produced parasites that emerged during the following April and May. Some cocoons, however, only yielded adults in October 1930 and one did so in October 1931. The eggs are laid during the autumn, singly in the needles of the new growth, and hatch between the end of April and early May. It thus appears that *D. sertifer* normally hibernates in the egg stage. In this respect it differs from the common pine sawfly (*D. pini*, L.) and almost all others, since *D. pini* follows the general rule in hibernating in its cocoon as a fully developed larva.

The parasites reared from the cocoons of *D. sertifer* were 3 individuals of *Exenterus marginatorius*, F., 2 of *Torocampus* (*Mesoleius*) *eques*, Htg., and 1 of *Lophyroplectus* (*Perilissus*) *luteator*, Thnb., the latter two being apparently new to Britain.

Rietra (E.). **Iets over den bouw en de levenswijze van** *Nemeritis canescens* **(Gravenhorst) als interne parasiet van de larve van** *Ephestia kuehniella* **Zeller.** [Some Account of the Structure and Life-history of *N. canescens* as an Endoparasite of the Larva of *E. kühniella*.]—Med. 8vo, 120 pp., 18 figs., 22 refs. 's-Hertogenbosch (Proefschrift Univ. Leiden), 1932.

In this study in Holland of the Ichneumonid, *Nemeritis canescens*, Grav., parasitising the larvae of *Ephestia kühniella*, Zell., the development of the parasite was followed throughout the egg and larval stages. The structure of the eggs and embryos and the five larval instars, as well as their position in the host are described. No special size of host larva was selected for oviposition, and the number of eggs in a single host varied considerably, but as the first instar larvae attack each other, only one survives. Details are given of the feeding and respiration of the various larval instars and of the reactions of the host larvae.

Newton (H. C. F.). **On** *Atomaria linearis* **Stephens (Coleoptera, Cryptophagidae) and its Larval Stages.**—*Ann. Appl. Biol.*, xix, no. 1, pp. 87–97, 2 figs., 4 figs., 14 refs. Cambridge, February 1932.

The bionomics of *Atomaria linearis*, Steph. (pigmy mangel beetle), which attacks mangels and sugar-beet, are reviewed from the literature [*R.A.E.*, A, xv, 168; xviii, 316; xix, 380, etc.], and some new observations made in England are recorded. The egg and larva are described for the first time. The most serious damage is caused by the adults, which bite off the " shoots " of the germinating seedlings. The small tap root is pitted with holes and in severe infestations may be eaten through, though the central tissues may be undamaged, the plants appearing healthy. Small holes are often made in the leaves, but this damage is usually insignificant. As the plant increases in size, the root attack becomes less dangerous, provided that the weather is favourable to growth. Beetles may be found at the same time in the crown of the plant and in the surface layer of soil. The disappearance of the adults towards the end of June has been suggested to be due to a migration from the mangel fields, but from observations on a plot of sugar-beet in 1931 the author considers that they may congregate in numbers about individual plants, perhaps for breeding purposes. In

the laboratory it was found that a single beetle is capable of preventing the development of a newly germinated seedling, whereas when the full cotyledon stage was reached the depredations of many had no noticeable effect. Various control measures are reviewed. *A. linearis* was first observed by the author in late May on mangels and in early June on sugar-beet. There appears to be one generation a year. In the laboratory the egg stage took 4–6 days and together with the larval stage occupies a maximum period of 6 weeks. The larvae apparently live freely in the root system of the plant.

Borchers (F.) & May (E.). **Erfahrungen bei der Arsenbekämpfung des Kiefernspanners in biologischer und technischer Hinsicht.** [Experience in biological and technical respects in combating the Pine Geometrid.]—*Forstw. Zbl.*, lii, 1930, 18 figs. (Abstract in *Z. PflKrankh.*, xlii, no. 4, pp. 174–175. Stuttgart, 1932.)

Observations in Germany show that moisture from dew is essential for normal feeding by the larvae of the pine Geometrid [*Bupalus piniarius*, L.] [*cf. R.A.E.*, A, xx, 76] and that the measurement of excreta is the best indicator of feeding activity. The presence of 6 healthy pupae (or in poor stands 2–3) per 11 sq. ft. of ground indicates the probability of very severe infestation. In very dry weather arsenical dusts should be applied only in the very early forenoon, as later in the day they do not adhere sufficiently.

Fleischmann (R.). **Wirkungen des Halmfliegenbefalles bei verschiedenen Sommerweizensorten.** [The Effect on different Varieties of Summer Wheat of Infestation by the Stem Fly.]—*Fortschr. Landw.*, 1931, p. 193. (Abstract in *Z. PflKrankh.*, xlii, no. 4, pp. 178–179. Stuttgart, 1932.)

Experiments in Hungary showed that the degree of infestation of summer wheat by the stem fly, *Chlorops* [*taeniopus*, Mg.] differs according to the variety, the resultant crop losses varying between 1·6 and 23·7 per cent. The infestation is reduced with varieties that have a dense growth, for not only is the injury lessened proportionately but also physiologically, as the ears form earlier. Early varieties are therefore to be preferred.

Müller (K. R.). **Ueber die Lebensweise und Bekämpfung der Gartenhaarmücke** (*Bibio hortulanus* **L.**). [On the Life-history and Control of *B. hortulanus*.]—*Fortschr. Landw.*, 1930, p. 613, 4 figs. (Abstract in *Z. PflKrankh.*, xlii, no. 4, pp. 179–180. Stuttgart, 1932.)

In Germany, *Bibio hortulanus*, L., oviposits under crop remnants on beet and potato fields, and the larvae feed on potato tubers, sugar-beet, garden plants, and especially germinating cereals. The young shoots of beet seedlings are entirely eaten. Even in winter the larvae do not go deep into the soil. Pupation occurs early in May at a depth of 2–4 inches, the first adults appearing towards the end of the month. All débris, etc., should be removed from fields. Sowing may safely be done in April after deep ploughing, the sown area being well rolled. The adults may be caught on sticks smeared with adhesives.

Bambulovič (P.). **Die Vernichtung von Nadelwaldungen in Bosnien.** [The Destruction of coniferous Forests in Bosnia.]—*Sumarski List.*, 1930, p. 446. [In Croat with Summary in French.] (Abstract in *Z. PflKrankh.*, xlii, no. 4, p. 181. Stuttgart, 1932.)

Following the dry summer of 1928 and the cold winter of 1928–29, a very serious outbreak of *Ips typographus*, L., and *I.* (*Pityogenes*) *chalcographus*, L., occurred on spruce over an area of about 125,000 acres in eastern Bosnia. Unmixed stands have been completely destroyed and spruce in mixed stands is affected.

Boas (J. E. V.). **Ein neuer grosser Angriff von** *Lyda arvensis*. [A new and severe Attack by *Cephaleia arvensis*.]—*Dansk. Skorfor. Tidsskr.*, xv, pp. 1–23, 1930. [In Danish.] (Abstract in *Z. PflKrankh.*, xlii, no. 4, p. 184. Stuttgart, 1932.)

The tips of the crowns of spruce trees 50–80 years old have been severely attacked near Flensburg, Denmark, by *Cephaleia* (*Lyda*) *arvensis*, Panz., but not so as to require clear cutting of the infested stands. A detailed, illustrated account of this sawfly is given.

von Tubeuf (C.). **Epidemische Entnadelung (Kurztriebverlust) der Kiefernsprosse durch Cecidomyiose (Brachynterie).** [The epidemic Loss of Pine Needles through Infestation by *Thecodiplosis brachyntera*.]—*Z. PflKrankh.*, xlii, nos. 2–3, pp. 58–88, 97–121, 23 figs. Stuttgart, February–March 1932.

An annotated list is given of the gall-midges infesting conifers in Germany, together with a detailed account of *Thecodiplosis brachyntera*, Schwäg., and the galls it causes on the needles of pines. The loss of needles resulting from infestation is not considered to be of importance. Other insects causing injury to the needles are *Brachonyx pineti*, Payk., *Anthonomus varians*, Payk., *Luperus* (*Galeruca*) *pinicola*, Andersch, *Cryptocephalus pini*, L., and *Ocnerostoma* (*Argyresthia*) *piniarella*, Zell. Particulars of their morphology and bionomics are given from the literature.

Gante (T.) & Zimmer (R.). **Versuche zur Bekämpfung der "Grossen Schildlaus"** (*Eulecanium corni* (**Bché.**) **Ckll.**). [Experiments in combating *Lecanium corni*.]—*Z. PflKrankh.*, xlii, no. 3, pp. 121–123. Stuttgart, March 1932.

In experiments in South Germany with various insecticides against *Lecanium* (*Eulecanium*) *corni*, Bch., on plum, various proprietary brands of tar-distillates proved the most effective. These results confirm those of Thiem [*R.A.E.*, A, xx, 183].

Rebmann (O.). **Die bisherigen Ergebnisse der Schädlingsbekämpfung mit Aethylenoxyd (T-Gas).** [The Results hitherto obtained with Ethylene Oxide (T-Gas) in combating Pests.]—*Z. Gesundheitstech. u. Städtehyg.*, xxiv, no. 2, pp. 57–70, 20 refs. Dresden, February 1932.

This is a survey from the literature of the use of ethylene oxide alone or in combination with carbon dioxide (T-Gas) as a fumigant against insect pests.

GOETZE (G.). **Sind die Larven von Stilettfliegen (Thereviden) Roggenschädlinge ?** [Are the Larvae of Therevid Flies Pests of Rye ?]—*NachrBl. deuts. PflSchutzDienst*, xii, no. 3, p. 17, 1 fig. Berlin, March 1932.

For several years injury to rye in the district around Landsberg an der Warthe, Prussia, has been attributed by the farmers to Therevid larvae. A serious case was reported in the autumn of 1931, the plants being either deprived of their roots or eaten through just above ground level. Only Therevid larvae occurred either on or among the plants, but when they were placed in pots containing sprouting rye plants they did not attack them, so that it still remains doubtful whether these predacious larvae are also phytophagous.

LANGENBUCH (R.). **Ergebnisse mit der Sublimatmethode gegen die Kohlfliege im feldmässigen Kohlanbau.** [Results obtained with the Sublimate Method against the Cabbage Fly in Field Cultivation of Cabbage.]—*NachrBl. deuts. PflSchutzDienst*, xii, no. 3, p. 18. Berlin, March 1932.

Experiments in Saxony in 1931 have confirmed the value of mercury bichloride against the cabbage fly [*Phorbia brassicae*, Bch.]. Two applications of a 0·06 per cent. solution, on the 4th and 14th day after planting, proved quite satisfactory with cabbages planted on 2nd May, and no advantage was obtained by a third application.

ZWÖLFER (W.). **Zur Lehre von den Bevölkerungsbewegungen der Insekten.** [Regarding the Science of Changes in the Abundance of Insects.]—*Z. angew. Ent.*, xix, no. 1, pp. 1–21, 23 refs. Berlin, March 1932.

This is a criticism of the points dealing with causal analysis and the use of climograms in a recent paper by Martini [*R.A.E.*, A, xx, 56].

ELIESCU (G.). **Beiträge zur Kenntnis der Morphologie, Anatomie und Biologie von *Lophyrus pini* L. I. Teil.** [Contributions to the Knowledge of the Morphology, Anatomy, and Biology of *Diprion pini*.]—*Z. angew. Ent.*, xix, no. 1, pp. 22–67, 20 figs. Berlin, March 1932.

The material used in these investigations was collected in 1927–1929 in South Germany, where *Diprion* (*Lophyrus*) *pini*, L., was very abundant on pines. The morphology of the egg and the process of oviposition are described in detail. The female usually begins to lay eggs 2–3 hours after pairing and continues to do so for 3 days (rarely 6), oviposition occurring at any time of the day or night. From 10 to 20 eggs are deposited in each pine needle, with an observed maximum of 149 for one female. The females that emerge from overwintered cocoons usually select well-developed needles of the previous year, but when emergence is delayed until the end of June well-developed needles on the current year's shoots are preferred. It is on these shoots that the second generation, which appears about August, oviposits. Egg development, which is dealt with in detail, requires 19 days at 16–28°C. [60·8–82·4°F.] and 29 days at 13–15°C. [55·4–59°F.], observed limits being 11 and 30 days. An account is given of the hatching of the larva, and the larva itself and its biology are described in very great detail.

The period from hatching until completion of the spinning of the cocoon lasted 21–49 days in the case of males, and 58 in the case of a single female observed. The chief food-plant is *Pinus sylvestris*, other species offered experimentally being preferred in the following order: *P. montana*, *P. laricio*, *P. cembra*, *P. excelsa*, and *P. strobus*. In one test with *P. strobus* only, the larvae refused to feed and died of starvation. The manner of feeding and the forms of the excreta of the various larval instars are described.

MARCUS (B. A.). **Ein neues Kontaktmittel (Forestit-Merck) in der Schädlingsbekämpfung.** [A new Contact Insecticide, Forestit-Merck, in Pest Control.]—*Z. angew. Ent.*, xix, no. 1, pp. 68–84, 3 figs., 24 refs. Berlin, March 1932.

A detailed account is given of experiments in Bavaria with a proprietary dust insecticide applied by aeroplane to pine woods infested by *Panolis flammea*, Schiff. This insecticide acts on the nerves and muscles, and when used at the rate of about 44 lb. per acre killed practically all the larvae. The action is almost immediate and so is not affected by weather conditions subsequent to application, as is the case with arsenicals.

LEBEDEV (A. G.) & SAVENKOV (A. N.). **Die Nahrungsnormen des Kieferspinners (*Dendrolimus pini* L.).** [The Food Standards of the Pine Lasiocampid, *D. pini*.]—*Z. angew. Ent.*, xix, no. 1, pp. 85–103. Berlin, March 1932.

Continuing previous work on the biology of *Dendrolimus pini*, L., in the Ukraine [*cf. R.A.E.*, A, xviii, 336, 455], the amount of pine needles consumed by a larva was investigated. It was found that the weight of 600 needles can vary between 9 and 84·48 gms., so that the weight of 35 gms. estimated by Eckstein in 1911 is not an accurate basis for calculation. The counting of needles was therefore abandoned for accurate weighing to ascertain the average amount of food consumed by a larva. The complicated method employed is described. Tables show the results of larval feeding before and after hibernation, including the weights of the excreta. In the autumn feeding period, lasting 46–54 days, an average of 0·4134 gm. of needles was eaten. In spring during the last larval instars there is a great variation in the amounts consumed, chiefly due to difference of sex. The males require 15–17 gm. and the females 18–20. It is concluded that for practical purposes, a figure of 25 gm. may be accepted.

SCHWERDTFEGER (F.). **Betrachtungen zur Epidemiologie des Kiefernspanners.** [Considerations on the Epidemiology of the Pine Geometrid.]—*Z. angew. Ent.*, xix, no. 1, pp. 104–129, 3 figs., 22 refs. Berlin, March 1932.

In his account of the end of the infestation by the pine Geometrid, *Bupalus piniarius*, L., in the Letzlinger district, Germany, in 1930 [*R.A.E.*, A, xix, 724], the author did not enter into a causal analysis of the outbreak. In view of Zwölfer's recent work on factors concerned in outbreaks of insects and particularly of *Panolis flammea*, Schiff. [xix, 660, 613], he now attempts with the information gained in the

outbreak of 1925–1930 to present new data on the epidemiology of *B. piniarius* by mathematical methods and to show the difficulty of applying Zwölfer's theoretical formulae to practical work. He concludes that if the analysis of a past outbreak is difficult, the possibility of prediction on these lines must be even more remote. Finally it is shown how little is really known of the simplest facts in the bionomics of *B. piniarius*.

FRIEDERICHS (K.). **Kiefernspanner und Parasiten nach der Gradation.** [The Pine Geometrid and its Parasites after an Outbreak.]—*Z. angew. Ent.*, xix, no. 1, pp. 130–143. Berlin, March 1932.

Very little is known of the occurrence of Lepidopterous forest pests and their parasites in the periods between outbreaks of the former. After the end of an outbreak in 1928–1929 in Mecklenburg of the pine Geometrid [*Bupalus piniarius*, L.], its numbers in general were too small to be measurable, but in some places a certain number of pupae could be found. In one forest there were 13·1 pupae per square metre (10·76 sq. ft.) in 1929–30, and only 0·38 in 1930–31. Of 132 pupae collected in Mecklenburg in 1930–31, 18 were parasitised by Tachinids, 10 by Ichneumonids and 4 by unknown parasites. There was a notable decrease in larval and pupal parasites from 1930 to 1931.

As a whole, the pine moth [*Panolis flammea*, Schiff.] was even less abundant than *Bupalus* (1 pupa per 20·25 sq. metres) but in south-western Mecklenburg there was an increase of the moth in 1930, and in the south-east injury by it occurred in 1931. In general only one pupa of the pine Sphingid [*Sphinx pinastri*, L.] was taken per 81 sq. metres, but in the south-western forest of Kaliss there were 0·56 per sq. metre, some of which were parasitised. Parasites obtained from pupae in Brandenburg were the Ichneumonid, *Aphanistes ruficornis*, Grav. (*s.l.*) and, more rarely, the Tachinid, *Phryxe erythrostoma*, Htg.

FAHRINGER (J.). **Zwei neue Braconidenarten als Feinde einer Mordraupe.** [Two new Braconids as Enemies of a predacious Caterpillar.]—*Z. angew. Ent.*, xix, no. 1, pp. 144–146, 2 figs. Berlin, March 1932.

The Braconids, *Phanerotoma buchneri*, sp. n., and *Agathis bischoffi*, sp. n., are described from Assam as parasites of *Holcocera pulverea*, Meyr., which is predacious on the lac insect, *Laccifer* (*Tachardia*) *lacca*, Kerr.

WILLE (J.). **Der Zuckerrohrbohrer, *Diatraea saccharalis* Fabr., ein bisher unbekannter Schädling am Weizen in den Küstengebieten Perus.** [The Sugar-cane Borer, *D. saccharalis*, a hitherto unknown Pest of Wheat in the coastal Districts of Peru.] —*Anz. Schädlingsk.*, viii, no. 3, pp. 25–29, 2 figs., 9 refs. Berlin, March 1932.

Diatraea saccharalis, F., is the most serious pest of sugar-cane in Peru, where it also infests maize and, to a limited extent, rice. In June 1930 reports of the destruction of wheat plants in various stages of growth led to the discovery of this Pyralid in the stems. Details are given of the injury, which may be divided into the skeletonising of the leaves; feeding in the young plants, with destruction of the heart-shoot; feeding in the shooting haulm, with consequent bending over

of the haulm; and feeding in the eared haulm, with stoppage of seed development and subsequent bending over of the haulm. All these forms of injury can be produced successively by a single larva.

The shortest larval life observed was 28 days, in summer, and the longest 53, in winter. In the winter, from May to September, the average percentage of infestation was 2–5; in the summer it was 10, with an exceptional instance of 20. In all cases the moths had flown from neighbouring sugar-cane fields, wind being the chief agent of spread. Of the parasites that attack *D. saccharalis* on sugar-cane, *Trichogramma minutum*, Riley, was never found in eggs in the wheat-fields, which may be explained by its limited power of spreading and by ecological differences between wheat and cane fields. The larval parasites, *Ipobracon rimac*, Wolcott, and *Paratheresia claripalpis*, Wulp, however, were present to nearly the same extent as on cane.

Kovačević (Ž.). **Die Verbreitung von *Aphelinus mali* in Jugoslavien.** [The Distribution of *A. mali* in Jugoslavia.]—*Anz. Schädlingsk.*, viii, no. 3, pp. 29–31, 2 figs. Berlin, March 1932.

Prior to 1930 the only known natural enemies of the woolly apple aphis [*Eriosoma lanigerum*, Hausm.] in Jugoslavia were *Exochomus quatuorpustulatus*, L., and *Chrysopa perla*, L., both being of little importance. In June 1930 material parasitised by the Chalcidoid, *Aphelinus mali*, Hald., was received from Italy, when it was discovered that this parasite was already present in some parts of the country. It was subsequently found to be fully established in Slavonia, between the Save, Drau and Danube, and the woolly aphis in some localities there was parasitised to the extent of 85–90 per cent. Parasitism is highest (90 per cent.) in spring, lowest (20–30 per cent.) in summer, and rises again in autumn (50–61 per cent.). *A. mali* had probably been introduced into Jugoslavia on Californian apples.

Hergula (B.). **Recent Experiments on the Application of *Metarrhizium anisopliae* against the Corn Borer.**—*Internat. Corn Borer Invest. Sci. Rep.*, iv, pp. 46–62, 2 fldg. tables, 2 refs. Chicago, Ill., 1931.

In further experiments in the practical application of *Metarrhizium anisopliae* against the larvae of *Pyrausta nubilalis*, Hb., in Jugoslavia [*cf. R.A.E.*, A, xix, 154], dusting artificially infested maize plants with spores of the fungus in concentrations of 5,10 and 20 volumes per cent. in potato starch reduced infestation to 0·8 per cent. The effectiveness of the spores was equally apparent in 1930, when the weather was wet and the temperature relatively low, and in 1931 during a dry and very hot season. The plants were artificially infested after they had been dusted, and the method, whether with eggs or young larvae, had no essential influence on the number of larvae later recovered from the plants. Both methods will therefore be used in future experiments with fungi of this type, although infesting the plants with eggs more nearly approaches the conditions in nature. In cases where the experimental plants had been sprayed with water before dusting with spore powder, greater mortality was secured by increasing the spore concentrations of the mixtures, but with plants that had not been sprayed the percentages of the larvae recovered with concentrations of 5,10 and 20 per cent. were respectively 0·3, 1·5 and 0·6. The effectiveness of the fungus was reduced by increasing the time interval between dusting

and infestation of the maize plants, and after an interval of 7 days no effect whatever was produced. Suggested causes for this loss of effectiveness are : spraying before spore dusting, which may prevent germination ; rain and wind, which may wash or blow the spores off the plants; and direct insolation. It has been shown that *Metarrhizium* spores are destroyed after 5 minutes' exposure to a temperature of 44–60°C. [131–149°F.], and it is not known what temperatures the spores can sustain through direct insolation on the plant on hot summer days.

The effectiveness of *Metarrhizium* spores was weaker on sprayed plants than on plants not treated with water before spore treatment, but as the differences are not uniform, they are probably influenced by other unknown factors. Potato starch was found to be too heavy a substance for mixing with the spores, which did not readily adhere to the particles, so that the concentrations constantly diminished and required renewal.

[Bugdanov (G. B.).] **Бугданов (Г. Б.). Programme and Instructions for the Study of the Pests of, and the Damage caused to, Maize and of Methods of protecting it.** [*In Russian.*]—18 pp., 27 refs. Ordzhonikidze, Stantz. Zashch. Rast. gorsk. sel'sko-khoz. Inst. [Plant. Prot. Sta. Gorskiĭ Agric. Inst.], 1932. (With a Summary in English.)

In view of the economic importance of maize in southern Russia, a programme is outlined for the organisation of observations on the bionomics and distribution of the pests attacking it, the estimation of their numbers in a given area, and the study of their importance and control. A key is appended in which the pests, given under their popular names, are distinguished by the injury caused to the plants. Among the most injurious are *Pyrausta nubilalis*, Hb., and *Pentodon idiota*, Hbst.

[Bugdanov (G. B.).] **Бугданов (Г. Б.). On the Question of the Effect of various Insecticides on the Larvae of the Apple Moth, *Hyponomeuta malinella* Zell.** [*In Russian.*]—14 pp., 8 refs. Ordzhonikidze, Stantz. Zashch. Rast. gorsk. sel'sko-khoz. Inst. [Plant Prot. Sta. Gorskiĭ Agric. Inst.], 1932. (With a Summary in English.)

In view of the serious damage caused by *Hyponomeuta malinellus*, Zell., to apple in the Vladikavkaz area, field and laboratory experiments with sprays were carried out in May in the years 1927–29. Details of the results are shown in tables. In the case of third instar larvae, the percentages of mortality obtained in 30–36 hours were 41–70 with lead arsenate at the rate of 2–4 lb. to 240 gals. water, 30–64 with Paris green or sodium arsenite in the same concentrations, and 9–58 with barium chloride at the rate of 1–3 lb. to 6 gals. After 48–50 hours, however, the percentages were 89–100 with lead arsenate, 41–83 with Paris green and sodium arsenite, and 28–80 with barium chloride. Rain and atmospheric humidity decreased the rate of mortality by 1–7 per cent. in the case of lead arsenate, 1–20 per cent. in the case of Paris green and sodium arsenite, and 2–41 per cent. in the case of barium chloride. Similar rates of mortality were obtained in the control of the fourth instar larvae after a further period of 13 hours.

Applications of 4 lb. of Paris green and 3 or 4 lb. of sodium arsenite in 240 gals. sometimes scorched the leaves, and the author recommends lead arsenate at the rate of 1 lb. to 80 gals.

Vouk (V.) & Klas (Z.). **Conditions influencing the Growth of the insecticidal Fungus** *Metarrhizium anisopliae* **(Metsch.) Sor.**—*Internat. Corn Borer Invest. Sci. Rep.*, iv, pp. 24–45, 6 figs., 16 refs. Chicago, Ill., 1931.

A detailed account is given of experiments carried out in 1931 in Jugoslavia to determine the effect of such factors as temperature, hydrogen-ion concentration and culture media on the growth of *Metarrhizium anisopliae*, a fungus that attacks *Pyrausta nubilalis*, Hb. The range of temperatures favourable to normal development of the fungus was found to be between 10 and 30°C. [50 and 86°F.]. A culture medium of ground rice and water (pH 6·9) was found to be desirable for large-scale production. Spores may be collected from such a substratum four successive times with a stiff brush. By this method 0·03248 gm. of spores was obtained from 1 sq. cm. of surface of the medium, or about 9½ oz. to 1 sq. yd. It was further calculated that approximately 0·03 gm. of spores in a 10 per cent. mixture with starch is sufficient to dust one fully-matured maize plant. On this basis 6½ lb. of spores would be required to dust 100,000 mature maize plants, or double the number of young seedlings.

Martelli (G. M.). **Note di biologia sulla** *Rhagoletis cerasi* **(L.) Loew (Diptera-Trypaneidae).** [Biological Notes of *R. cerasi*.]—*Boll. Lab. Zool. Portici*, xxvi, pp. 20–45. Portici, 15th January 1932.

During observations on *Rhagoletis cerasi*, L., from April to June 1931 in southern Italy, the egg-stage in cherries on the tree lasted 7–9 days with an average day temperature of 20–22°C. [68–71·6°F.], and the larval stage 9–10 days. The adults emerged from the overwintered pupae early in May. The longest adult life observed was 32 days for a captive female fed on honey and water. The flies were chiefly active in the morning after the air was warmed by the sun. Males mated on the day of emergence, and females about 30 hours later. Unripe cherries were selected for oviposition, and the eggs were laid preferably in the part of the fruit that faced north. The puncture in the fruits, the larval mines, and the appearance of infested cherries are described. In somewhat light soil, pupation took place at a depth of 1–1·6 ins.

Russo (G.). **Contributo alla conoscenza degli Scolitidi. iii. Ilesinini dell'olivo.** [A Contribution to the Knowledge of Scolytids. iii. The Hylesinini of the Olive.]—*Boll. Lab. Zool. Portici*, xxvi, pp. 87–114, 8 figs. Portici, 31st January 1932.

These biological notes are the result of laboratory studies at Portici and field work in various parts of Italy and Sicily. Much of the information is similar to that in another paper [*R.A.E.*, A, xix, 620]. *Hylesinus oleiperda*, F. (*taranio*, Danth.) breeds in both healthy olive trees and in freshly cut branches. In healthy trees it has one generation a year, eggs being laid in June and young adults emerging in the following May. In cut branches there are two generations. The eggs of the first hatch in June, and the adults emerge and oviposit in September. The larvae of the second generation hibernate, and the adults emerge in June. The predacious Cucujid, *Laemophloeus perrisi*, Grouv., often occurs in the breeding galleries. The Cleonymid, *Cheiropachys colon*, L., is a very abundant parasite, while *Eurytoma*

masii, Russo, and the Pteromalid, *Rhaphitelus maculatus*, Wlk., are common. Another Pteromalid, *Cerocephala cornigera*, Westw., *Eupelmus degeeri*, Dalm., and a Braconid, *Ecphylus* sp., also occur. The most important parasites of this Scolytid also attack *Scolytus amygdali*, Guér., on almond [*cf.* xx, 253]. The young adults of the latter emerge in April, whereas the parasites do so in March, and where almonds grow near olives, it is therefore advisable not to destroy infested almond branches until the end of March.

Phloeotribus scarabaeoides, Bern., has three generations a year in Sicily and South Italy, and some adults of the third may give rise to larvae that hibernate. Its natural enemies are similar to those of *H. oleiperda*. *P. oleiphilus* is regarded as a synonym of *P. scarabaeoides*. Both the former and *Cornesiella sicula*, the status of which is considered doubtful, were first described by Del Guercio in 1925 (*Atti R. Accad. Georgofili*, Florence (5) xxii) and not in 1931, as stated in this *Review* [xix, 621].

Hylesinus (*Leperisinus*) *fraxini*, Panz., has two generations a year, the adults appearing in July and September. At Portici, besides the Chalcidoids mentioned above, two Braconid parasites were obtained from it, viz., *Dendrosoter protuberans*, Nees, and *Spathius* (?) *exarator*, L. *Phloeophthorus cristatus*, Fauv., and *P. rhododactylus*, Marsh., occur in Sicily, the former being more common. They breed in cut, broken, or withered olive branches.

Mendizábal (M.). **La mosca del olivo.** [The Olive Fly.]—*Bol. Soc. ent. España*, xiv, no. 8, pp. 131–136, 3 figs. Madrid, 1931. [Recd. March 1932.]

This is a popular account of the bionomics of *Dacus oleae*, Gmel., on olives in Spain and of its control by means of sweetened bait-sprays or glass bait-traps.

Vayssière (P.). **Quelques observations sur les coccides des régions australiennes.**—*C. R. Soc. Biogéogr.*, viii, pp. 57–59, 1 ref. Paris, 1931.

In Australia, in New Zealand and in India and Ceylon there is a very rich local Coccid fauna, but the species are little distributed elsewhere, although their food-plants, such as *Eucalyptus* from Australia and bamboo from India, are now to be found everywhere.

Balachowsky (A.). **Sur le comportement des Coccidae appartenant à la Faune ubiquiste tropicale, acclimatés en Afrique du Nord et dans le Bassin Mediterranéen.**—*C. R. Soc. Biogéogr.*, viii, pp. 48–52. Paris, 1931.

The Coccid fauna of the western Mediterranean comprises 200 species, of which about two-thirds are indigenous. The others have been introduced directly through human agency and are almost entirely subtropical. The ubiquitous Coccid fauna of tropical countries is completely different and biologically distinct from that of subtropical regions, the occurrence of the two groups being determined by ecological conditions. Tropical species become established in subtropical regions only in a few places that are specially favourable as regards temperature and humidity. In the Jardin d' Essai of Algiers purely

equatorial species such as *Asterolecanium bambusae*, Boisd., and *A. miliaris*, Boisd., have been established for over 60 years without spreading, in spite of the sale of pot plants. Other tropical Coccids recorded there are *Lepidosaphes hawaiiensis*, Mask., *L.* (*Coccomytilus*) *bambusicola*, Ckll., *Chionaspis bambusae*, Ckll., *Pseudococcus nipae*, Mask., *Pulvinaria psidii*, Mask., *Aspidiotus spinosus*, Comst., *Morganella longispina*, Morg., *Fiorinia nephelii*, Mask., and *Diaspis boisduvali*, Sign. In Lower Egypt, however, where the ecological conditions are favourable, many tropical species, including *Pseudococcus filamentosus*, Ckll., and *Phenacoccus hirsutus*, Green, have become established and are serious pests.

Entomology.—*50th Ann. Rep. Ohio Agric. Expt. Sta. 1930–31*, Bull. 497, pp. 70–85. Wooster, Ohio, January 1932.

J. S. Houser reports that owing probably to the drought, injurious insects were unusually abundant in Ohio during the summers of 1930 and 1931. This was particularly true with regard to borers such as *Ips grandicollis*, Eichh., a serious outbreak of which occurred in 10-year-old plantings of red pine (*Pinus resinosa*), and *Scolytus rugulosus*, Ratz., which caused severe injury in orchards, particularly to peach. The situation with regard to *Cydia* (*Grapholitha*) *molesta*, Busck, is discussed by R. B. Neiswander and M. A. Vogel. The area bordering Lake Erie, in the northern part of the State, was the only locality where a crop of peaches was produced during 1930, and where large numbers of the larvae entered into hibernation in the autumn and successfully survived the winter. It was also the only locality where the moth caused serious injury to peaches during the following season, over 50 per cent. of the fruit being infested. Owing probably to the cool rainy weather during the latter part of August and early September and the activities of parasites, infestation towards the end of the season 1931 proved much lighter than conditions during June and July had indicated. Parasites were much more active in 1931 than in previous years, and in nearly all localities the degree of parasitism appeared to increase as the season advanced. Collections made in two northern counties showed a parasitism of 2·1 and 20·5 per cent. in June, as against 72·5 and 75·9 in August. In 1931, *Macrocentrus ancylivora*, Roh., was responsible for 44·4 per cent. of the total parasitism in one of these counties, where it had not been taken before liberations had been made in 1930, and for 80·3 per cent. of the total parasitism in two orchards. The parasite was recovered during both years from all points of liberation, and in two instances had spread for a distance of $\frac{3}{4}$ mile. In the southern counties, however, where liberations had been also made, none was recovered. Over 15,700 individuals of this Braconid were liberated during the two years under review. The results of experiments against *C. molesta* with sprays showed that summer oil is apparently the most promising material so far used. Dusts impregnated with oil proved of little value, but evidence was obtained that much more lead arsenate could safely be used in such dusts than in sprays.

Apple pests are discussed by C. R. Cutright. Investigations on *Cydia* (*Carpocapsa*) *pomonella*, L., showed that although the emergence of moths in the orchard and in cages begins and finishes at the same times, there is a difference of as much as two weeks between the peaks of emergence, and this would greatly influence the timing of the sprays. Injury by *Rhagoletis pomonella*, Walsh, has gradually become less

severe, following a serious infestation during 1929. In the north, the adults usually begin to appear between 8th and 12th July and continue to emerge until late August.

J. P. Sleesman reports that the bulk of the adults of the spring brood of *Hylemyia antiqua*, Mg. (onion maggot) emerged between 10th and 15th May and that the heaviest injury was caused between 10th and 17th June. Four generations were reared in the laboratory. Tests against this fly show that a control of 68 and 70 per cent. respectively was obtained with pure mercurous chloride and with a 6 per cent. mercurous chloride dust with gypsum as a carrier, the materials being drilled in directly on top of the seed, the mixture at the rate of 100 lb. to the acre. Investigations to determine the resistance of varieties of onions to *Thrips tabaci*, Lind., showed that on one variety the average number of thrips was 27 to each plant as against 388 on another. E. A. Herr states that *Taeniothrips gladioli*, Moult. & Stnw. [*R.A.E.*, A, xix, 310] has for the first time caused severe injury to gladiolus in the State.

Experiments by H. L. Gui against *Epitrix cucumeris*, Harr., on potatoes definitely showed that in sprays, calcium arsenate was far superior to lead arsenate. A dust of 5 lb. calcium arsenate, 10 lb. copper sulphate and 40 lb. lime proved of considerable value in control.

L. L. Huber, C. R. Neiswander, J. B. Polivka and E. G. Kelsheimer report that during 1931, *Pyrausta nubilalis*, Hb., increased in abundance in the north-western part of the State and caused commercial losses to maize, particularly in four counties where the stalk breakage averaged 10 to 15 per cent. The seasonal development of the moth is discussed, and a table is given comparing the percentages of larval survival during 1926–31. The year 1931 was particularly favourable to *P. nubilalis*, and the vigorous development of the maize was probably partly responsible for the high larval survival (23·9 per cent.).

McConnell (H. S.). **Parasitism and Over Winter Control on Peach Moth.**—*Trans. Peninsula Hort. Soc.*, 1931, pp. 105–108. Dover, Del. [1932.]

Experiments were carried out in Maryland during 1929–31 to discover a material for use against the hibernating larvae of the oriental fruit moth [*Cydia molesta*, Busck]. An unsuccessful attempt was made to asphyxiate the larvae and to prevent the entrance of moisture into the cocoons by spraying the twigs in spring with a proprietary miscible oil in which was dissolved cellulose or specially processed rubber. More encouraging results were obtained by spraying the hibernating larvae on strips of corrugated paper with coal tar oil or pine tar oil, with the addition of paradichlorobenzene or carbon tetrachloride, each sample being diluted with water. The coal tar sprays gave a higher percentage of control. These materials might be used in packing sheds where larvae of *C. molesta* and the codling moth [*C. pomonella*, L.] over-winter in numbers.

As the result of a survey to determine the distribution of *Macrocentrus ancylivora*, Roh., colonies of this parasite were liberated in the western portion of the State [*cf. R.A.E.*, A, xvii, 195]. Of the liberations made during the past two years, five were successful, four unsuccessful, and two made where the parasite was already present. In this State the parasite does not breed to any extent on the strawberry leaf roller [*Ancylis comptana*, Froehl.] or on the ragweed borer [*Epiblema strenuana*, Wlk.].

Hurt (R. H.). **Some Recent Spray Practices in Virginia.**—*Trans. Peninsula Hort. Soc.*, 1931, pp. 139–144. Dover, Del. [1932.]

The addition to lead arsenate sprays of " zinc Bordeaux " at the rate of 4 lb. zinc sulphate and 4 lb. hydrated lime to 50 U.S. gals. water has proved most satisfactory in preventing arsenical injury to peaches. During 1931 a large number of commercial orchards in Virginia sprayed with this mixture showed practically no arsenical injury, whereas those that were sprayed with lead arsenate and hydrated lime suffered from heavy defoliation and severe scorching (25–50 per cent. of the foliage). Similar conditions were observed in experimental plots.

In experiments carried out in 1929, rosy aphis [*Anurapis roseus*, Bak.] and green aphis [*Aphis pomi*, DeG.] were successfully controlled on apple by a dormant spray of redistilled tar oil of American manufacture, and in 1930 also by an ordinary American tar creosote oil, both sprays being emulsified with soap and used at the rate of 5 gals. tar oil to 100 gals. spray solution, and by an English tar distillate, which is a miscible emulsion and was used at the rate of 5 gals. stock emulsion to 95 gals. water. A light neutral tar oil did not prove satisfactory. No injury to the buds was observed, and the trees developed normally. More extensive experiments were undertaken in 1931 in three different orchards. A heavy redistilled tar oil emulsified with soap was used at concentrations of 77 and 68 per cent. in the stock emulsion. The latter concentration used at the rate of 4 gals. to 96 gals. water (equivalent to 2·72 per cent. tar oil) reduced the infestation in two orchards by 80 and 84 per cent. From these results it appears that tar distillates are the most satisfactory and the cheapest method of controlling Aphids that has been evolved in recent years. They appear, however, to be only half as effective as petroleum oils against San José scale [*Aspidiotus perniciosus*, Comst.]. Tar distillates and petroleum oils can be combined without lowering the effectiveness of either, and it is suggested that this Coccid and the Aphids might be controlled by one application of a combined spray. The author considers that it would be more advisable for growers to obtain tar oil emulsions from manufacturers than to prepare their own, owing to the difficulty in manufacture, the varying quality of the tar oils and the cost entailed.

Ewing (H. E.). **Early Records and present known Distribution in the United States of three recently introduced Mites.**—*Proc. Ent. Soc. Washington*, xxxiv, no. 2, pp. 13–16, 4 refs. Washington, D.C., February 1932.

The author points out that fixation of the exact date and place of the first occurrence of introduced pests is often inaccurate, and deals with the early records and present distribution of two rat mites. *Eutetranychus latus*, C. & F., which attacks *Buxus sempervirens*, was found in Virginia in November 1915, and in Ohio in May 1931, but no record of its occurrence in the United States has previously been published.

Busck (A.). **Description of a new Cosmopterygid Leaf Miner (Lepidoptera) on** *Helianthus*.—*Proc. Ent. Soc. Washington*, xxxiv, no. 2, pp. 17–20, 2 pls. Washington, D.C., February 1932.

A description is given of the adult of *Teladoma helianthi*, gen. et sp. n., the larvae of which mine the leaves of *Helianthus* and *Xanthium* in Illinois.

Heinrich (C.). **A New Species infesting** *Annona* **(Lepidoptera : Olethreutidae).**—*Proc. Ent. Soc. Washington*, xxxiv, no. 2, pp. 20–23, 1 pl. Washington, D.C., February 1932.

The adults of both sexes and larva of *Talponia batesi*, sp. n., are described from Guatemala, where the larvae were found feeding in the fruit of *Anona cherimolia*.

Hartzell (A.) & Wilcoxon (F.). **Some Factors affecting the Efficiency of Contact Insecticides. ii. Chemical and toxicological Studies of Pyrethrum.**—*Contr. Boyce Thompson Inst.*, iv, no. 1, pp. 107–117, 2 figs., 19 refs. Yonkers, N.Y., March 1932.

The following is taken from the authors' summary : A method is described for the determination of comparative toxicity to *Aphis rumicis*, L., of samples of pyrethrum flowers without the use of a wetting agent. The relation between pyrethrin content and toxicity has been determined by this method for a series of dilutions of an analysed pyrethrum concentrate. A loss in pyrethrin content of pyrethrum flowers was caused by heat, sunlight, ultra-violet light and natural ageing. In all cases a decrease in pyrethrin content as determined chemically corresponded to a decreased toxic effect on insects. It appears that whenever two samples show a significant difference in toxicity by the biological test, the analytical results will confirm this fact. Partly purified pyrethrum concentrates, exposed in a thin layer to sunlight, showed a loss in toxicity accompanied by the formation of insoluble material. No lasting protection was afforded by spraying nasturtium plants with pyrethrum solutions and infesting them with *Aphis rumicis* after they had dried. Pyrethrum concentrates were toxic to a number of cold blooded animals, including species representing ten orders of insects, when applied externally to the integument and even when applied locally to regions of the body far removed from vital organs. These concentrates injected into the body cavity produced toxic symptoms almost immediately. Preliminary results indicate that there is an axial gradient in susceptibility to pyrethrum when extracts are applied to larvae of the tomato worm, *Protoparce* (*Phlegethontius*) *quinquemaculata*, Haw., the anterior region being most susceptible. When adults of the rose chafer, *Macrodactylus subspinosus*, F., in an apparently moribund state from pyrethrum intoxication were exposed to a higher temperature, the processes of recovery and death were both accelerated.

Bruner (S. C.). **Algunos Insectos dañinos a nuestros Frutales.** [Some Insects harmful to Orchards in Cuba.]—*Circ. Estac. expt. agron. Santiago de las Vegas*, no. 75, 12 pp., 2 pls. Havana, December 1931. [Recd. March 1932.]

The insects discussed include *Thrips tabaci*, Lind., on onion, *Selenothrips* (*Heliothrips*) *rubrocinctus*, Giard, on mango, the Tingid, *Corythuca gossypii*, F., on *Anona* and castor [*Ricinus communis*], and the Eurytomid, *Bephrata cubensis*, Ashm., which infests the seeds of *Anona* [*R.A.E.*, A, xii, 4]. Pests of papaya (*Carica papaya*) are the Sphingid, *Erinnyis alope*, Dru., the larvae of which are parasitised by the Braconid, *Microgaster flaviventris*, Cress., and a Tachinid ; an unidentified Pyralid that bores into various parts of the plant and sometimes skeletonises the leaves ; a Trypetid that infests the fruits ; the

Aleurodid, *Trialeurodes* (*Aleurochiton*) *variabilis*, Quaint., with which is associated a sooty fungus that sometimes covers the trees ; and the Coccids, *Aulacaspis pentagona*, Targ., and *Pseudoparlatoria ostreata*, Ckll., the latter of which is attacked by Chalcid parasites and by the Coccinellid, *Chilocorus cacti*, L.

Monte (O.). **Um percevejo sugador do tomate, *Phthia picta*, Drury.** [A Bug sucking Tomato, *P. picta*.]—*Chacaras e Quintaes*, xlv, no. 2, pp. 222–224, 1 fig. S. Paulo, 15th February 1932.

The Coreid, *Phthia picta*, Dru., the nymphs and adult of which are described, occurs on tomatos in the State of Minas, Brazil, especially on the fruits. It appears about mid-October and becomes scarce towards the end of November. Individual plants are sometimes severely infested while adjoining ones are entirely free. The best measure consists in spraying with nicotine and soap.

Monte (O.). **Dois coleopteros prejudiciais ás rosas.** [Two Beetles injurious to Roses.]—*O Campo*, iii, no. 1, pp. 111–112, 2 figs. Rio de Janeiro, January 1932.

Roses in the State of Minas, Brazil, are attacked by two Melolonthids, *Ceraspis variabilis*, Burm., and *Isonychus griseus*, Mannh., the beetles feeding inside the buds, which fail to open and consequently rot.

Cottier (W.). **An Insect Survey of Potato Foliage in New Zealand.** —*N.Z. J. Sci. Tech.*, xiii, no. 3, pp. 125–139, 5 figs., 11 refs. Wellington, N.Z., December 1931. [Recd. March 1932.]

An extensive survey of potato in New Zealand in preparation for studies on the transmission of virus diseases [*cf. R.A.E.*, A, xviii, 290] shows the following insects to be common on the foliage in summer : *Myzus persicae*, Sulz., *M. solani*, Kalt. (*pseudosolani*, Theo.), *Macrosiphum gei* Koch, *Erythroneura zealandica*, Myers, *Thrips tabaci*, Lind., *Aeolothrips fasciatus*, L. (which is said to attack *T. tabaci*), the Lathridiid, *Melanophthalma gibbosa*, Hbst., and two Collembola. Their food-plants and brief notes on their biology are given, except in the case of the Collembola, and their distribution in the South Island is shown.

It was found that both *Myzus persicae* and *Macrosiphum gei* were able to overwinter in the asexual stage ; various crucifers appear to be preferred winter food-plants of the former. The relative abundance of the three Aphids in 1929–30 is discussed. *M. persicae* was the most abundant at the beginning of the season, but *M. gei* eventually predominated.

Gourlay (E. S.). **A new and important Flax-infesting Weevil. *Phaeophanus fairburni* Brookes.**—*N.Z. J. Sci. Tech.*, xiii, no. 3, pp. 163–169, 9 figs. Wellington, N.Z., December 1931. [Recd. March 1932.]

Early in 1931 *Phormium* [*tenax*] on D'Urville Island, New Zealand, was found infested by *Phaeophanus fairburni*, Brookes (MS.). The eggs and larvae are briefly described. The adults begin to feed on the apical halves of the leaves in the evening and remain hidden among dead leaves, etc., at the base of the plant during the day. In confinement the basal parts of the thicker leaves were eaten as readily as the

thinner blades. The weevils react instantly to light, feeding being suspended and immobility sustained for a considerable time. They are able to live for long periods without food, but cannot fly, and isolated clumps of flax 30 ft. from the main infested areas were free from infestation. The eggs are laid at night at the base of the plant and hatch in an average of 21–25 days. In captivity, oviposition had ceased by the end of the first week in April, and only a few adults were still alive by 11th July. The larvae tunnel into the soft tissue of the plant and may even penetrate partly into the fibrous stool. The infested areas become blackened and the adjacent tissue swollen with gum, and the plant is soon killed. Pupation takes place in cocoons of plant fibre and soft black rotted material, under the débris at the base of the plant.

Jarvis (E.). **Cane Pest Combat and Control.**—*Queensland Agric. J.*, xxxvii, pt. 2, pp. 92–93. Brisbane, 1st February 1932.

The fact that collected adults of the greyback cane-beetle [*Lepidoderma albohirtum*, Waterh.] were devoured with avidity by young ducks and fowls suggests that an excellent poultry food could be made from the dried bodies of these beetles. An analysis of a kind of meal made from these insects has shown it to contain 63·75 per cent. proteins, 10·20 per cent. nitrogen, 1·75 per cent. potash and 1·66 per cent. phosphoric acid.

Adam (D. B.) & Pescott (R. T. M.). **Strawberry Culture. Fungus Diseases and Insect Pests.**—*J. Dept. Agric. Vict.*, xxx, pt. 1, pp. 21–25, 1 pl. Melbourne, January 1932.

Among the insects attacking strawberries in Victoria the weevil, *Rhinaria perdix*, Pasc., is probably the most injurious. The adults, which are able to fly, are present from about November until February, being most numerous in December. The eggs are laid in the crowns of the plants, usually early in December, and hatch in 6 weeks. The larvae first attack the crowns, often causing them to decay, and later tunnel in the stalks. The pupae hibernate in the soil. Owing to the presence of ripe fruit at the time of the appearance of the larvae on the plants, sprays cannot be used, but a poison bait proved very effective. It consists of 1 lb. calcium arsenate, 1 lb. sugar or molasses, 9 lb. bran and sufficient water to make a wet mash, small portions (about the size of a walnut) being placed round the plants. Cultivating the soil early in spring will expose many of the pupae to birds. The same bait may be used for the control of *Listroderes obliquus*, Gyll. (*Desiantha nociva*, Lea), the larvae and adults of which hide in the soil during the day and attack the plants at night. All weeds on land adjoining strawberry plots should be destroyed, and when the crop is not ripening, the plants may be sprayed with 1 lb. lead arsenate in 25 gals. water. Cockchafers (*Heteronyx* sp. and *Haplonycha* sp.) cause severe injury to strawberries. The eggs are laid on the ground or on the crown of the plant and hatch in about 3 weeks. The larvae attack the roots, finally killing the plants. The pupae are usually found in September. Cultivation in spring will expose the larvae to birds. The principal damage by the larvae of *Oncopera intricata*, Wlk. [*cf. R.A.E.*, A, xvii, 533] is caused to the young shoots and foliage. They can be controlled with the bait recommended against *R. perdix*, and soil fumigation with carbon bisulphide may also prove of value. Considerable damage is frequently

caused by *Thrips tabaci*, Lind., and *T. imaginis*, Bagn., which attack the young flower buds and young fruits, and against which a contact spray should be used. Other pests include *Haltica pagana*, Blkb., and *Tortrix postvittana*, Wlk., against both of which spraying with lead arsenate is recommended.

JARVIS (E.). **Cane Grub Parasite for North Queensland from Philippines.**—*Queensland Agric. J.*, xxxvii, pt. 2, pp. 93–97, 1 pl., 1 ref. Brisbane, 1st February 1932.

An account is given of the exchange of Scoliid parasites of cane-grubs between Queensland and the Philippine Islands [*cf. R.A.E.*, A, xx, 186, 213, 247]. In Queensland there occurs a honey-bearing plant, *Stachytarpheta dichotoma*, closely resembling *S. jamaicensis*, which is reported to be a favourite feeding plant of the adults of *Campsomeris aureicollis*, Lep., in the Philippines [xix, 575]. The adults of both sexes of *C. aureicollis* are described. The question of parthenogenesis among Scoliids is discussed, and it is pointed out that unfertilised eggs may occasionally give rise to females, though males are usually produced. In the case of unfertilised females of *C. aureicollis* that had lived 6 weeks and laid a number of eggs, it was found that when males were at length available (derived in the present instance from females of the same brood as the females in question) pairing took place normally. Unfertilised females begin to oviposit a few hours after emerging from their cocoons. The eggs are usually deposited on the mid-ventral line on the third or fourth abdominal segment of the paralysed host grub in such a way that they project from the body. Under normal conditions the adults are on the wing between 9 and 10 a.m. in search of honey-bearing flowers ; when occupied in feeding, they may easily be captured. The adults confined in breeding cages are given a drop or two of syrup, consisting of 1 part honey to $1\frac{1}{2}$ parts water, on the surface of a leaf once a day after the removal of the parasitised host grub from the cage. A female generally produces an average of one egg a day. If not carefully handled, the adult of this species may inflict a painful sting.

CHAN KWAI SHANG. **Notes on the Control of the Litchi Stink Bug, *Tessaratoma papillosa*, Dru. (Heteroptera, Pentatomidae).**—*Lingnan Sci. J.*, x, no. 4, pp. 399–411, 4 refs. Canton, 30th November 1931. [Recd. March 1932.]

A brief general account is given of the Pentatomid, *Tessaratoma papillosa*, Dru., as occurring on litchee (*Litchi chinensis*) in South China [*R.A.E.*, A, xx, 169], and control measures suitable to local conditions are discussed. The adult bugs should be collected in winter and early spring during their hibernation period, and the eggs in spring and summer. For the former, long-handled insect nets with deep double bags are used. These are made in the form of a shallow funnel inside a deep one, both having open bottoms, that of the outer bag being closed with string while the inner one remains open so that the bugs will fall through. In severe weather the bugs are inactive and may be shaken or knocked down into the net or on to the ground or picked by hand from the branches. Collections should be made in the colder parts of the day, and dead or diseased bugs should be left on the tree to assist dissemination of disease. The eggs, which are chiefly laid on foliage reached by sunlight, are easily collected. Oviposition begins

with the first warm weather, generally at the beginning of April. The nymphs may be dealt with at the same time ; they may be shaken from the trees into a can of water and kerosene, or when very numerous caught by means of a sticky band on the trunk [*cf. loc. cit.*]. Experimental investigations indicate that the bugs begin to hibernate some time in October and resume activity in late March. An examination of 7,704 individuals showed the ratio of the sexes to be one-third more males than females. Since the adults are apparently able to cover a distance of at least 200 yards, co-operative destruction of bugs over a large area and within a definite period is necessary in order to check continuous infestation.

Identity of two Egg-parasites of the Lychee Stink-bug, *Tessaratoma papillosa*, **Dru.**—*Lingnan Sci. J.*, x, no. 4, p. 535. Canton, 30th November 1931. [Recd. March 1932.]

The two egg-parasites of the Pentatomid, *Tessaratoma papillosa*, Dru. (litchee stink bug) referred to in a recent paper [*R.A.E.*, A, xx, 169] have now been identified as a Eupelmid, *Anastatus* sp. and a Scelionid, *Microphanurus* sp.

Hoffmann (W. E.). *Critheus lineatifrons* **Stål injurious to Bamboo.**—*Lingnan Sci. J.*, x, no. 4, pp. 502–503, 9 figs. Canton, 30th November 1931. [Recd. March 1932.]

The Pentatomid, *Critheus lineatifrons*, Stål, was found in July and August 1926 in the Canton District of Kwangtung severely injuring a kind of bamboo that is used for making brooms and baskets. The eggs were found from 10th July to 6th August in masses of 14 on the inside of the tips of the leaf sheaths, and were parasitised in some cases. The bugs seem to feed exclusively on the sap of bamboo. The nymphs, which were found during August, have been taken on the new culms only ; adults are sometimes present on the older culms but have not been observed to feed on them.

Papers noticed by Title only.

Takahashi (R.). **Records and Descriptions of the Coccidae from Formosa. Part i** [including 1 new genus and 6 new species].—*J. Soc. Trop. Agric.*, iii, no. 4, pp. 377–385, 6 figs. Taiwan (Formosa), December 1931.

Vayssière (P.). **Monophlébines et Pseudococcines de l'Afrique du Nord (Hem. Coccidae)** [including 3 new species].—*Bull. Soc. ent. Fr.*, xxxvii, no. 2, pp. 24–28, 18 figs. Paris, 1932.

[Gavalov (I.).] **Гавалов (И.). Beiträge zur Kenntnis der Cocciden des Kaukasischen Gebietes.** [Contributions to the Knowledge of the Coccids of the Caucasian Region (56 species with notes on food-plants, local distribution and some parasites, chiefly fungi).] [*In Russian.*]—8vo, 22 pp., 76 refs. Krasnodar, 1931. (With a Summary in German.) [Recd. March 1932.]

[Mordvilko (A. K.).] **Мордвилко (А. К.). The Aphids of Yakutiya. Scientific Results of the Expedition of the Academy of Science of the U.S.S.R. to the Yakutsk Region in 1927.** [*In Russian.*]—*Annu. Mus. zool. Acad. Sci. URSS.*, xxxii, no. 2, pp. 289–291. Leningrad, December 1931.

Börner (C.). **Mitteilungen über Blattläuse.** [Communications on Aphids, including one new species from Switzerland.]—*Anz. Schädlingsk.*, viii, no. 3, pp. 32–33. Berlin, March 1932. [*Cf. R.A.E.*, A, xx, 192, etc.]

Jaynes (H. A.). **El** *Acrotomopus atropunctellus*, **Boh., una plaga de la caña de azúcar de la Argentina.** [*A. atropunctellus*, a Pest of Sugar-cane in Argentina.]—*Rev. ind. y agríc. Tucumán*, xxi, no. 9–10, pp. 179–184, 4 figs., 2 refs. Buenos Aires, 1931. [Translation of paper already noticed, *R.A.E.*, A, xx, 13.]

Tooke (F. G. C.). **The** *Phoracantha* **Beetle.** [*P. semipunctata*, F., on *Eucalyptus* in South Africa.]—*Fmg. S. Afr.*, 1932, reprint no. 5, 5 pp., 2 figs. Pretoria, January 1932. [*Cf. R.A.E.*, A, xvii, 245.]

[Romanovich (I. K.).] **Романович (И. К.). Mineral Oils as Insecticides. I. The Distillates of Petroleum. (A Summary of the Literature.)** [*In Russian.*]—*Plant Protection*, viii, no. 3, pp. 235–248, 46 refs. Leningrad, September 1931. [Recd. 1932.]

[Romanovich (I. K.).] **Романович (И. К.). The Fluorine Compounds as Insecticides. (A Summary of the Literature)** [*In Russian.*]—*Plant Protection*, viii, no. 4, pp. 351–374, 84 refs. Leningrad, October 1931. [Recd. 1932.]

Sproeien en Sproeiers. [Sprays and Sprayers.]—*Versl. Meded. Plantenziekten. Dienst*, no. 33 (3rd revd. edn.), 50 pp., 8 pls. Wageningen, November 1931. [*Cf. R.A.E.*, A, xii, 184.] [Recd. 1932.]

Jones (H. A.). **Crystalline Solvates of Rotenone.**—*J. Amer. Chem. Soc.*, liii, pp. 2738–2741, 3 refs. Easton, Pa., 1931.

Clark (E. P.). **Deguelin. III. The Orientation of the Methoxyl Groups in Deguelin, Tephrosin and Rotenone.**—*T.c.*, pp. 3431–3436, 9 refs. [*Cf. R.A.E.*, A, xix, 680.]

Smith (L. E.) & LaForge (F. B.). **Rotenone. XIII. Oxidation of Methylderritolic Acid and the Synthesis of 2, 3, 5- and 2, 3, 6-Trimethoxybenzoic Acids and their Derivatives.**—*T.c.*, pp. 3072–3077, 5 refs. [*Cf. R.A.E.*, A, xix, 312, 680.]

Haller (H. L.) & LaForge (F. B.). **Rotenone. XIV. The Relation of the Optical Activity of some Rotenone Derivatives to the Structure of Tubaic Acid.**—*T.c.*, pp. 3426–3431, 14 refs.

LaForge (F. B.). **Rotenone. XV. The Structure of Derric Acid.**—*T.c.*, pp. 3896–3901, 8 refs.

LaForge (F. B.), Haller (H. L.) & Smith (L. E.). **Rotenone. XVI. Interpretation of some characteristic Reactions of Rotenone.**—*T.c.*, pp. 4400–4408, 17 refs.

Gersdorff (W. A.). **Bibliography of Ethylene Dichloride** [with a subject index.]—*Misc. Pub. U.S. Dept. Agric.*, no. 117, 60 pp. Washington, D.C., February 1932.

Zwölfer (W.). **Ein verbesserter Williamscher Brücken-Thermostat.** [An improved Williams Bridge-thermostat.]—*Anz. Schädlingsk.*, viii, no. 2, pp. 13–16, 3 figs. Berlin, 15th February 1932.

HARUKAWA (C.), TAKATO (R.) & KUMASHIRO (S.). **Studies on the Rice-borer, *Chilo simplex* Butler. I. On the prolonged Emergence Period of the Moth in Spring. i.**—*Ber. Ōhara Inst. landw. Forsch.*, v, no. 1, pp. 177–207, 4 refs., 8 graphs. Kuraschiki, 1931.

It is suggested that in Japan differences in the conditions under which the larvae of *Chilo simplex*, Butl., hibernate may be one of the factors affecting the prolonged emergence period of the moths in spring, which usually lasts from 70 to 80 days. Studies were therefore carried out on the possible relationship between pupation and emergence and the temperature of the hibernacula. The methods employed for measuring the temperature inside rice straws are described. The types of hibernacula selected for test were harvested rice straws and tall and short rice stubble standing in the field. The straws were made into bundles about 2 inches in diameter to represent conditions in the outer layers of large piles of straw, the temperature of which it would be difficult to determine. The temperatures recorded in April, May and June for the years 1927 to 1930 inclusive are shown in tables and charts. The temperatures of straws and stubble, which were recorded 3–4 times during the day only, were considerably higher than the air temperatures at the same times. In 1931, when night as well as day temperatures were taken, the minimum temperature of the straws was in almost all cases slightly lower, and the maximum invariably markedly higher than the corresponding air temperatures. Out of 33 days there were only three on which the average air temperatures exceeded that of straws, and in one instance that of straws exceeded that of air by as much as 4·5°C. [8·1°F.], the sun's rays during the day more than compensating for the fall of temperature in the straw at night.

In a straw pile the average temperature at a depth of about 1 ft. equalled or slightly exceeded that of the air until about 23rd May, after which conditions were reversed, the difference becoming gradually more pronounced as the season advanced. The rise of temperature within the pile was thus always slightly slower. The temperature of short stubbles was slightly higher than that of tall ones in fine weather, but soon after rain the short stubbles usually showed lower temperatures, probably owing to slower drying and cooling by evaporation. A bundle of straw in the sun showed usually but not invariably a higher temperature than one in the shade. The temperature of stubble was found to be lower than that of the bundle in the sun in most cases, but in 1930 no consistent relationship was observed. The temperature of the straw bundle in the shade was in nearly all cases lower than that of the stubbles. It is therefore concluded that in April and May the temperatures of hibernacula of *C. simplex* are in the following order : the outer layer of a straw pile in the sunshine ; short stubbles ; tall stubbles ; and straw bundles in the shade. From observations in 1931 it is concluded that the temperature in the inner part of a straw pile must be lower than that of stubbles.

Observations indicated that pupation and emergence of *C. simplex* occurred earlier in the outer layer of a straw pile in the sunshine than in the shade in spring and early summer, but there is probably no difference in the temperature or development of the moth in the inner parts of large straw piles, irrespective of their situation. Pupation and emergence were earlier in stubbles than in a straw bundle in the shade where the temperature was lower. In the cases cited, pupation and emergence are in direct relation to temperature, but although the

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temperature was higher in the straw bundle in the sunshine than in stubble, pupation developed more rapidly in the latter than in a straw pile in the sunshine. It is thought, however, that the bundle did not accurately represent the temperature of the pile, the interior of which must have had a lower temperature than the stubbles.

Attempts to ascertain the effect of contact water on pupation and emergence gave inconclusive results, and it is concluded that some unknown factor or factors other than temperature or moisture probably play a decisive part in the breaking-up of hibernation.

HARUKAWA (C.), TAKATO (R.) & KUMASHIRO (S.). **Studies on the Rice-borer, *Chilo simplex* Butler. II. Effect of constant Temperature upon the Development of the Rice-borer. i.**—*Ber. Ōhara Inst. landw. Forsch.*, v, no. 1, pp. 209–220, 4 graphs, 2 refs. Kuraschiki, 1931.

Experiments in rearing *Chilo simplex*, Butl., from egg to adult under various constant temperatures, humidity being maintained at 70–90 per cent., indicate that a small proportion of the eggs develop at 12°C. [53·6°F.], at which temperature the pupae also develop. Very few of the larvae develop at this temperature, the average period elapsing before the emergence of the survivors being 352·3 days. At 15°C. [59°F.] only 2·4 per cent. of the larvae reached the adult stage, the period elapsing before the emergence of the moth being about 200 days. At 20°C. [68°F.] the percentage of larvae reaching the adult stage was 25–30; the greatest percentage (57·8) was obtained at 27°C. [80·6°F.]. At 33°C. [91·4°F.] the percentage appeared to decrease slightly, but was still considerable. Subsequent experiments, the detailed results of which are not shown, indicated that the eggs do not hatch at 35°C. [95°F.], and the larvae rarely attain full growth. Adults were sometimes obtained from pupae kept at 35°C., but the moths were generally deformed. The optimum temperature, and that at which development is most rapid, appears to be between 30 and 31°C. [86 and 87·8°F.]. Whereas the rate of development of the egg decreases rapidly at 33°C., that of the larva and pupa remains unchanged, the rate of growth of the larva showing a tendency to increase even beyond 33°C. The rate of growth of the larva seems to be proportional to the rise in temperature between 20 and 30°C. [86°F.], and it can develop at higher temperatures than the egg and pupa.

STOREY (H. H.). **Leaf Curl of Tobacco in Southern Rhodesia.**—*Rhod. Agric. J.*, xxix, no. 3, pp. 186–192. Salisbury, Rhodesia, March 1932.

A few severe outbreaks of leaf-curl of tobacco were observed in Southern Rhodesia during 1931, and though the aggregate loss is likely to be small, the disease may become of increasing importance if left unchecked. The author considers the plants to be suffering from a virus disease identical with one occurring at Amani, Tanganyika, an account of which is given. At Amani it was successfully transmitted from infected tobacco and *Vernonia* sp. to healthy tobacco by a species of *Bemisia* considered by Kirkpatrick to be probably *B. gossypiperda*, Misra & Lamba, the vector of leaf-curl of cotton in the Sudan [*R.A.E.*, A, xix, 708]. An Aleurodid, probably the same species, was present in all the infected fields in Southern Rhodesia, and there is, therefore, no reason to doubt its association with the disease.

JACK (R. W.). **The Lesser Tobacco Wireworms.**—*Rhod. Agric. J.*, xxix, no. 3, pp. 197–201, 1 pl. Salisbury, Rhodesia, March 1932.

This paper on the Tenebrionids of the genus *Trachynotus* attacking tobacco, cotton and other crops in Southern Rhodesia is largely a reprint of one already noticed [*R.A.E.*, A, xvi, 535], but some additional baits are included [xvii, 606], and the solution in which the bait of chopped green stuff is dipped [xvi, 536] is now given as 1 lb. sodium arsenite, 8 lb. cheap sugar (or 1 gal. molasses) and 20 gals. water.

GHESQUIÈRE (J.). **Quelques parasites d'importation récente.**—*Bull. Cercle zool. congol.*, viii, fasc. 2, p. [56] in *Rev. Zool. Bot. afr.*, xxi. Tervueren, 15th March 1932.

Selenothrips (*Heliothrips*) *rubrocinctus*, Giard, has spread from Angola into the Lower Congo and thence to Leopoldville, its distribution reaching as far eastward as Stanleyville. Other injurious insects the range of which has been considerably extended in the Belgian Congo during recent years are the Coccids, *Pseudaonidia trilobitiformis*, Green, and *Icerya purchasi*, Mask., the weevil, *Cosmopolites sordidus*, Germ., and the potato moth [*Phthorimaea operculella*, Zell.].

STEER (W.). **Further Observations on the Habits of the Raspberry Beetle** (*Byturus tomentosus* **Fabr.**) **with special Reference to the Control of the Pest by Means of Derris.**—*J. Pomol. Hort. Sci.*, x, no. 1, pp. 1–16, 3 diag., 12 refs. London, March 1932.

Experiments were carried out in Kent during 1931 on the control of the larvae of *Byturus tomentosus*, F. (raspberry and loganberry beetle) before they enter the fruit of raspberry and loganberry. For spraying a proprietary preparation of finely ground derris root and powdered soap was used. It had a rotenone content of 0·6–0·7 per cent. and was used at the rate of 2 lb. to 40 gals. water, giving on dilution a suspension of derris in soap solution. Two applications reduced the infestation on loganberries from 66·3 to 14·6 per cent. and increased the weight of marketable fruit from 8·3 to 51·8 cwts. per acre. It is recommended that one application should be given 10–15 days after the opening of the first blossoms, followed by a second in about 10 days; under most conditions in Kent this would be approximately 10th and 20th June. On raspberries the infestation was reduced from 78·27 to 6·95 and 4·66 per cent. when 7 and 12 days respectively elapsed between the two applications. It is therefore suggested that the canes should be sprayed about 10 days after the beginning of flowering (10th–15th June) and again in 7–15 days (20th–25th June). About 500 gallons of spray to an acre are required for raspberries of average size and vigour, and care must be taken to wet all the flowers and fruits. The failure of this spray to control an infestation in 1929 [*R.A.E.*, A, xix, 638] indicates that it is advisable to use fresh materials. Experiments were also carried out with a home-made derris dust composed of 95 per cent. China clay and 5 per cent. (by weight) finely ground derris root with a rotenone content of 1·8–1·9 per cent., to establish a basis for further study on sprays and dusts of known rotenone content. Three applications on 10th, 17th and 23rd June reduced the infestation on raspberries from 44·4 to 8·4 per cent., and

some confirmation of these results was obtained in a supplementary trial on a commercial plantation of loganberries. The carrier left a considerable deposit on the fruit.

Observations showed that very few larvae had entered the raspberry fruits up to the end of June. Examination revealed the presence of large numbers of small larvae feeding on the tender buds and mining in the soft stem-tips of young canes. This record and one of eggs placed on the stems and petioles of raspberry are apparently new. In view of the exposed condition of the larvae a spray of 8 oz. nicotine, 10 lb. soap and 100 gals. water was applied on 1st July, 6 days before the picking of the crop began; the percentage of infestation was reduced from 70·9 to 36·5. The possibility of controlling the larvae at a later stage than that aimed at in the previous experiments depends on the larvae remaining exposed until a late stage in the development of the fruit. The pyrethrum wash used in the previous year [*loc. cit.*] was employed again in 1931, but poor results were obtained, apparently owing to its variable chemical composition. The cost of spraying loganberries and raspberries with the derris preparation is discussed.

Miles (H. W.). **Biological Studies of Sawflies infesting** *Ribes*.—*Bull. Ent. Res.*, xxiii, pt. 1, pp. 1–15, 5 pls., 9 refs. London, March 1932.

An account, based on field and laboratory observations, is given of the bionomics of three sawflies infesting *Ribes* in Great Britain. *Pteronus* (*Pteronidea*) *ribesii*, Scop., appears to confine its attacks to *Ribes*, particularly gooseberry and red currant. The adults live for an average of 7 days; those from overwintered larvae emerge over a period of about 3 weeks from the end of April. The females begin to oviposit shortly after emergence whether mating has taken place or not. The method of oviposition and the egg are described. The number of eggs laid by one female varies considerably and averages 47, 15–30 being usually inserted in the lower surface of one leaf. The egg and larval stages last about 9 and 20–24 days respectively. The prepupal stage is spent in the cocoon, usually in the top few inches of soil, and occupies from 6–8 days in the case of summer broods to 6 months or even a year in that of the autumn one. The development of the pupa appears to be rapid, and the adult emerges 7–8 days after pupal ecdysis. Laboratory observations indicate that whereas there are usually three generations a year, only one or two may be produced. Under natural conditions larvae can usually be found from May until early October. There is a considerable variation in the proportion of the sexes from generation to generation and from year to year, since the females are parthenogenetic and normally arrhenotokous.

Pteronus (*Pteronidea*) *leucotrochus*, Htg., which is also found on gooseberry, occurs only rarely and has been little studied. Oviposition began as soon as newly-emerged females were placed on gooseberry twigs, the eggs being laid singly or in twos on both surfaces of the leaves and the twigs. The number deposited by a single female varied from 30 to 53, and the incubation period was 10–11 days. The immature stages are briefly described and compared with those of *P. ribesii*. In contrast to the latter *P. leucotrochus* is univoltine. The adults are on the wing early in May, and the larvae are fully-fed by the end of May or beginning of June, when they enter the soil and remain there in cocoons until the following spring, the pupal stage being short. No example

of retarded development has been observed in the case of *P. leucotrochus*. In Gloucestershire the single brood of *P. leucotrochus* synchronised almost exactly with the first brood of *P. ribesii*, and both species are parthenogenetically arrhenotokous. From a study of the two species it seems possible that *P. leucotrochus* was the parent stock from which multi-voltine strains may have arisen and ultimately developed into *P. ribesii*.

The larvae of *P. ribesii* are frequently accompanied by those of *Pristiphora pallipes*, Lep., which though fairly common and occasionally abundant in Great Britain is more frequently recorded on the Continent, where in Holland and France it causes considerable injury to gooseberries and currants. Under laboratory conditions adults of different generations lived 6–12 days after emergence, but observations under field conditions in north-west England indicate that the duration of life is much less. Although the eggs are usually deposited in the edges of the leaves, 1–3 to a leaf, they are occasionally placed near the veins. Records of the number of eggs deposited by females in captivity showed an average of 33. The larvae hatch in 8–11 days. Those of the spring and summer broods mature in 12–18 days and those of the autumn one in 3 weeks. The former construct cocoons under débris on the surface of the soil about the bushes and the latter at a depth of about $\frac{1}{2}$ inch in the soil. The period spent in the cocoon varies from 14–16 days in the early broods to 220 in the autumn one. The females are thelyotokous, and the species depends mainly on parthenogenesis for its survival, no males having been observed throughout 4 seasons' observations, although they have previously been occasionally recorded. As the emergence from overwintered larvae extends over some days in April and May and oviposition continues for about a week, adults from the first brood of larvae have a scattered emergence throughout June and succeeding broods are not clearly defined, eggs and larvae being found till September. There are, however, normally four generations during the season.

MacGill (E. I.). **The Biology of** *Erythroneura* (*Zygina*) *pallidifrons*, **Edwards.**—*Bull. Ent. Res.*, xxiii, pt. 1, pp. 33–43, 6 figs., 20 refs. London, March 1932.

In view of the fact that in some countries Jassids are serious pests of crops and are suspected of being vectors of virus diseases of plants, further information on their biology appeared desirable, and *Erythroneura* (*Zygina*) *pallidifrons*, Edw., the common species infesting glass-houses in the British Isles, was taken as a type for investigation. It is pointed out that although leafhoppers infesting glass-houses were thought to belong to two species, *E. pallidifrons* and *E. parvula*, Boh., both of which occur in the open in Britain, material collected from several widely separated localities consisted entirely of the former, and it is suggested that injury recorded as due to *E. parvula* in greenhouses has been due to misidentification.

The insects were bred on cotton in glass-houses and on cotton, primula and geranium in the laboratory. The egg and five nymphal instars are described, and figures are given showing the characters distinguishing the adults of *E. pallidifrons* and *E. parvula*. *E. pallidifrons* has a wide range of food-plants and thus tends to become a serious pest in glass-houses. Both adults and nymphs apparently feed exclusively on the leaves, usually on the lower surface, but the

stylets are often pushed through the palisade tissue, so that the damage is frequently observed first on the upper one. The injury appears to be mechanical, as it does not normally spread over the leaf from one puncture. On badly infested plants, the leaves are much soiled by the fluid excrement of the nymphs, which forms a suitable medium for the growth of moulds. The nymphs rarely move once they have found a favourable place on a leaf except in search of fresh food, but in the fifth instar are fairly active. The flights of the adults are generally short, being from leaf to leaf of the same or neighbouring plants. The eggs are usually laid in the veins on the lower surface of the leaves. There is no evidence of parthenogenesis. The female begins to oviposit 7–14 days after pairing and lays an average of about 50 eggs. The oviposition period in most cases lasted from 2 to 3 months. The length of the life-cycle varied from 85–88 days in January-March to 25–28 days in June-July, lengthening again to 45–46 days in July-September. Preliminary experiments on the infestation of cotton showed that there was a definitely higher infestation on plants receiving 1,000 cc. of water a week than on those receiving only 500 cc. Plants sown in March were more highly infested than those sown in May. Tilling of the soil did not seem to influence the degree of infestation. An unidentified Mymarid parasite was obtained from the eggs of *E. pallidifrons* from two localities, but attempts to breed it have so far been unsuccessful.

JOHNSTON (H. B.). **Notes on two Locusts of minor economic Importance in the Sudan.**—*Bull. Ent. Res.*, xxiii, pt. 1, pp. 49–64, 7 refs. London, March 1932.

Anacridium moestum, Serv. (tree locust) and *Cyrtacanthacris tatarica*, L. (brown-spotted locust), two species normally having solitary habits but liable under certain conditions to give rise to hoppers of a swarming type, and both potential pests, have been studied in the Sudan, where the former is considerably the more important. *A. moestum*, essentially an African species with a wide distribution on that continent, has been sub-divided into two well defined geographical races, *A. moestum melanorhodon*, Wlk., being the northern one and *A. moestum moestum* occurring throughout south and central Africa, but both meeting and overlapping in the Sudan. Their geographical distribution is discussed in detail, the determining factor being the presence or absence of certain kinds of trees. In the Sudan, the chief habitat is among the natural thickets of *Acacia* that grow in the drier parts.

In addition to the usual solitary form of *A. moestum melanorhodon*, which is rarely observed gregariously except in winter, a kind of swarming form was observed in the summer and autumn of 1924, and larvae of a different appearance were produced, the adults resulting from which were smaller, although not structurally different from the normal phase. All stages are described, and the adults are compared with those of the solitary phase of *Schistocerca gregaria*, Forsk.

Adults are usually encountered singly in localities covered by a sparse growth of *Acacia* and other trees, and may invade cultivated crops near the trees on which they normally live. Breeding is confined in northern Sudan to the summer periods of rains, and there is only a single brood. During the period November-March the locusts become gregarious, resting in numbers along branches of trees. Instances are given of damage caused during this period to cotton, limes and guavas.

After the dispersal of the sedentary swarms, the adults frequent trees during the dry spring months, and mate commonly in June when a little rain has fallen. Scattered flights are noticed during this month, and early in July females containing eggs are common in some years. North of Lat. 14°N., oviposition becomes general from the end of July in places where rain has fallen. Females apparently lay eggs 10–20 days after mating. South of Lat.14°N., mating takes place earlier with the earlier incidence of rains, and movement of adults has been observed in April and May and mating in May. In the south-western Sudan eggs may be laid from May onwards throughout the summer; they are deposited in damp sand, the egg-pod containing 150–200. Although the species is normally single-brooded in the northern Sudan, there is evidence of a partial second brood in the southern parts of the country where the rainy season is prolonged. The incubation period varies from 23 to 65 days, and there is no evidence of a diapause in this stage. The young larvae, which immediately climb the nearest plant or tree, are negatively geotropic, and in cages strongly positively phototropic. They can apparently subsist on common types of ground vegetation during the search for normal food. The length of the larval stage varies from 48 to 69 days. In addition to leaves of trees of the genus *Acacia*, the preferred larval food, those of *Zizyphus spinachristi* are readily eaten. Other food plants are a number of cultivated fruit and shade trees, particularly lime and *Ficus* spp. Feeding normally occurs at night, the upper portions of younger trees being particular points of attack. Young *Acacia* trees are frequently barked.

No natural enemies of the egg have been found. Sarcophagid flies have been bred from the adult, and both larvae and adults are attacked by hunting wasps, of which the commonest is a Sphegid. Some larvae are caught by spiders, but birds are probably the chief predators. Large numbers of adults are sometimes attacked by a disease, the nature of which is unknown. Although there is at present no evidence in the Sudan of anything but short flights in search of food or damp ground for oviposition, it is possible that reported flights, sometimes of considerable magnitude, taking place at night are those of *A. moestum*, as no other species is known to move except by day. Whereas the powerful build of the adult would suggest that it is capable of long and continued flight, dissection failed to reveal a distended condition of the air sacs such as occurs in the well-known migratory locusts.

Rearing experiments carried out to determine the effect of crowding during the larval stages on the possible existence of phases failed to produce any differences from those observed in the field, and dense crowding invariably produced heavy mortality. Although in addition to occasional defoliation of fruit trees, more serious damage to gum trees has been reported, the essentially intermittent character of the injury renders *A. moestum melanorhodon* a minor pest. Control measures include the digging up of egg-pods and the destruction of the very young larvae before they have been able to leave the ground, but once they have ascended the trees they cannot be reached except by spraying, which would injure the foliage.

C. tatarica, which is the less important of the two species under consideration, merits attention owing to its capacity for sudden and unexpected acceleration in breeding. It is said to occur in most parts of Africa and in India, where it occasionally becomes a pest of cotton, but appears to be absent from Egypt. It has been recorded in the Sudan from as far north as Lat.18°N., but probably occurs even beyond

this line, and has been observed as far south as Lat.4°N. It is not migratory, except in an extremely limited sense when in search of food, and has never been encountered swarming except on land under crops. The adult and larval stages are described.

Observations made chiefly in the irrigated cotton-growing district adjacent to the Blue Nile show that breeding may continue throughout the year, though at a very reduced rate in winter, whereas in other areas reproduction is confined to the wet season, after which the adults scatter to trees and bushes where they pass the months until the next rain. Great variation was observed in the duration of various stages of the life-cycle at different seasons. The egg-pods are laid in almost any place that is moist, and a female is apparently capable of laying 1,000 eggs. Continuous flight of the adults has never been observed, and migration probably never occurs, but the constant occurrence of *C. tatarica* on cotton shows that it is capable of passing to cultivated areas from its natural habitat among *Acacia* scrub and then increasing in numbers until it can destroy the crop. Rapid breeding may occur on cotton during April and May, owing to early showers, and in October and November young cotton may also be attacked by hoppers that are the progeny of females that approach the irrigated land from the surrounding country on the cessation of rains. After the cutting of the cotton crop in May the young adults resort to adjacent gardens and trees, where they cause heavy defoliation. *C. tatarica* has never been observed attacking Graminaceae, although it has a wide range of food-plants.

Observations in breeding cages show that crowding produces dark hoppers, indicating a certain parallelism between the colour forms and those of true locusts. No satisfactory control method has been devised for the hoppers, which are not attracted by poison baits, but adults when collected in trees have been attracted to the ground and killed in large numbers by a bait consisting of bran, treacle and sodium arsenite thrown out in the evening.

A note is appended on methods employed in rearing locusts in the Sudan.

King (H. H.) & Ruttledge (B. A.). **On Experiments in the Use of Poison Dusts against adult** *Locusta migratorioides*, **Rch. & Frm., in the Sudan.**—*Bull. Ent. Res.*, xxiii, pt. 1, pp. 65–68, 2 refs. London, March 1932.

In 1930 and 1931 the Anglo-Egyptian Sudan was invaded not only by *Schistocerca gregaria*, Forsk., but also by swarms of *Locusta migratoria migratorioides*, Rch. & Frm., which appeared in the country after an interval of over forty years. Poisoned bait [*R.A.E.*, A, xvii, 507] proved to be effective against hoppers of the latter, but they did not eat it so readily as those of *Schistocerca*, so that baits with a higher proportion of arsenic and with the addition of treacle are recommended. The oviposition of *L. migratoria migratorioides* occurs in almost any type of soil, so that hoppers appear not only in the sandy areas with sparse vegetation, but also in tall dense vegetation where they escape detection. The control of this species by baits alone is, therefore, unlikely to prove practicable.

On the other hand, the swarms of adults move in dense, massed formation and at no great height from the ground, which should make them vulnerable to poison dust. Experiments were carried out by

holding a locust suspended on a thin wire and causing it to flutter in a cloud of dust of sodium arsenite powdered to pass through a standard 240 sieve. Locusts that had fluttered in the dust cloud for approximately twenty seconds showed signs of discomfort within half an hour and died after about two hours ; their tracheae were found to contain appreciable quantities of arsenic, which suggests that if a sufficient quantity of poison dust penetrates through the spiracles, paralysis and death result. Paris green and arsenious oxide had a much slower action when tested in the same way, so that it would appear that the speed of action depends on the solubility of the arsenic salt. At higher temperatures death occurs more rapidly than at a low one. No evidence was obtained that arsenic was absorbed through the integument, and precautions were taken to avoid its being introduced into the digestive system.

The practical application of this method by dusting flying swarms from aeroplanes should offer no difficulties. The results of these preliminary experiments are published in view of the seriousness of the situation as regards *L. migratoria migratorioides* in many parts of Africa.

Le Pelley (R. H.). *Lygus simonyi*, **Reut. (Hem. Capsid.), a Pest of Coffee in Kenya Colony.**—*Bull. Ent. Res.*, xxiii, pt. 1, pp. 85-99, 1 pl., 2 figs., 6 refs. London, March 1932.

In March and April 1930, a serious condition of coffee bushes was observed in Kenya, in which the flower " spikes " at an early stage in their growth turned black, failed to open and did not set fruit. This condition was found to be due to the feeding of the Capsid, *Lygus simonyi*, Reut., which resulted first in the spotting of the anthers and later in the rotting of the stamens and subsequent blackening of the unopened petals [*cf. R.A.E.*, A, xviii, 440]. The small black spike or cap to the bud so formed is typical of the damage in the field. At present coffee is the only known food-plant of the bug. The egg is inserted so far into the bud as to be completely hidden. In the laboratory eggs were laid, but failed to hatch, and first instar nymphs usually died. The length of the instars varied considerably, probably because coffee with flower spikes could not always be provided for food. Thus the third and fourth instars varied between 3 and 7 days and the fifth instar between 10 and 14. The adults lived for 3 weeks. In the plantation *L. simonyi* may be found in all stages at any time throughout the year. The nymphs are usually found in the buds and blossom spikes and when disturbed run rapidly along the branches but do not drop to the ground readily. The early instars are very small and difficult to see. The adults also are usually found in the blossom clusters, but fly readily when disturbed. They are often in flight in the mornings and evenings but during the heat of the day usually rest in shady positions. A small Lygaeid, *Geocoris ruficeps*, Germ., preys on *L. simonyi* but is only seen occasionally. In three cases the larva of an internal parasite was dissected from a nymph, but in no case was the adult reared.

The chief factor governing the increase of the bugs is the presence of coffee spike ; large numbers were found during and directly after the blossoming that occurs near the beginning of the long rains in March or April and produces the bulk of the crop, and at the time of the less heavy flowering that occurs in September and October after the

beginning of the short rains. Normally almost the entire crop is the result of these two flowerings, and the Capsid would be unable in these circumstances to increase sufficiently quickly to do serious damage before most of the blossom had set satisfactorily. Owing to the peculiar climatic conditions in 1930 the coffee flowered repeatedly and *L. simonyi*, which was present in large numbers from after the first blossoming in March until June, was maintained by the constant flowerings and was thus enabled to destroy the majority of them. In July-September (dry months) there was no flowering, and the infestation decreased to such an extent that 50 per cent. of the September-October flowering set fruit, but owing to a further increase in numbers of the pest at this time most of the later blossomings were destroyed. The constant flowerings may have been stimulated partly by the fact that no fruit was set, but observations where Capsids were scarce showed that the normal condition of two blossomings was upset by some other factor, probably climatic. Thus a serious failure of flowering appears to be produced by the bug under abnormal flowering conditions. Some other abnormal conditions of the buds, not considered to be caused by *L. simonyi*, are described.

The distribution of the bug is discussed. It appears to be widely spread throughout Kenya Colony at altitudes of from 4,500 to 6,500 ft., and although it was generally more serious at the higher altitudes, one severe attack took place at about 5,000 ft.

Control measures that proved unsatisfactory are briefly discussed, and a detailed description is given of the application of a paraffin extract of pyrethrum [xix, 645].

PEARMAN (J. V.). **Some Coccophagous Psocids (Psocoptera) from East Africa.**—*Stylops*, i, pt. 4, pp. 90–96, 8 figs., 2 refs. London, 15th April 1932.

The following species, which are recorded as being predacious on *Pseudococcus citri*, Risso, are described from Kenya Colony: *Ypsiloneura kirkpatricki*, gen. et sp. n., *Caecilius signatipennis*, End., and the following new species of the latter genus: *C. pallidus*, *C. ambiguus*, *C. obscurus*, *C. lucidus*, *C. gilvus*, and *C. brunneonitens*. These coccophagous species all belong to the family CAECILIIDAE, which is typical of the folicolous category of Psocids, as distinct from the corticolous class, which pass their entire existence on tree-trunks or rock surfaces, subsisting mainly on *Pleurococcus* and algae. The folicolous species are specially equipped for travelling over smooth leaf surfaces on which the bark species are helpless. Their natural food has not been precisely determined, but it was found impossible to rear them on *Pleurococcus*. On the other hand they appear to nibble the surface of fresh leaves and many readily eat insect eggs, though their usefulness is probably limited to the destruction of Coccid and possibly Aphid eggs. They are unlikely to be effective against well-established pests, but might often be successful in overcoming them at the onset of attack, and as they are not entirely dependent on animal food, they would not die off when that was exhausted. Moreover they do no appreciable damage to foliage. As most of them have two broods annually and nymphs and adults have identical feeding-habits, a species would have an effective period of about 6 months. The progeny of a single female averages 20, but they are liable to attack, mainly in the egg stage, by Mymarids, Rhynchota, mites and even their own species.

Russo (G.). **Il deperimento delle piantagioni di cotone nella Somalia Italiana.** [The Decline of Cotton Plantations in Italian Somaliland.]—*Agric. colon.*, xxvi, nos. 1–3, pp. 3–28, 74–88, 132–144, 8 pls., 2 figs. Florence, January–March 1931.

Paoli has concluded that the chief cause of the present decline of cotton plantations in Italian Somaliland is leaf-curl produced by the Jassid, *Empoasca facialis*, Jac. [*R.A.E.*, A, xviii, 659; xix, 731], but in this report, based on work in experimental plots and in the field, it is ascribed to a complex of ecological, biological and cultural factors, which are discussed. "Leaf-curl" is a vague term; several forms occur, one due to *E. facialis* and others to unhealthy conditions of the plant. The injury caused by *E. facialis* is due to its saliva and not to the transmission of a virus, and operates only on plants weakened by unfavourable soil and cultural practices unsuited to the conditions. Inadequate weeding prevents the breaking up of the soil into a fine mulch to avoid evaporation of soil moisture, after which excessive irrigation encourages the production of wood instead of bolls, effects a sudden change in the dry environment of the roots, and favours infestation by fungi and *Aphis gossypii*, Glov. In Nigeria, a leaf-curl has been attributed to an Aleurodid [xviii, 364; *cf.* also xix, 708], but in Italian Somaliland leaves covered with Aleurodids have remained uncurled, while curl was observed in screened plants entirely free from insects.

Platyedra gossypiella, Saund., is the chief pest of cotton in Somaliland, where the larvae do not appear to have a latent period in stored cotton. Alternative food-plants include *Abutilon asiaticum*, *Thespesia danis*, and *Hibiscus* spp. Up to September only 2–5 per cent. of the bolls are attacked, so that the first true crop is almost free from injury, but in October 50 per cent. and in November nearly all the bolls are infested. The Braconid, *Microbracon kirkpatricki*, Wlkn., sometimes destroys 50 per cent. of the larvae. Other pests include the spiny bollworms, *Earias biplaga*, Wlk., and *E. insulana*, Boisd., which cause a loss of about 15 per cent. of flower buds and young bolls and have the same alternative food-plants as *P. gossypiella*; the Eumolpid, *Syagrus rugiceps*, Lef., the larvae of which attack the roots and the adults the leaves; *Heliothis obsoleta*, F., against which the sowing of trap rows of maize among the cotton is suggested; *Diparopsis castanea*, Hmps., which feeds inside the bolls, and also infests other Malvaceae; *Pyroderces simplex*, Wlsm. (?); *Dysdercus cardinalis*, Gerst.; *Oxycarenus hyalinipennis*, Costa, which may be checked by destroying wild cotton, *Abutilon*, *Hibiscus* and fallen cotton-bolls; *Hercothrips* (*Heliothrips*) *indicus*, Bagn. (?); and termites.

Carbone (D.) & Fortuna Fiume (E.). **La vaccinazione dei bachi da seta. (Terza nota preventiva.)** [The Immunisation of Silkworms. (Third preliminary Note.)]—*Boll. Ist. sieroter. milan.*, xi, no. 3, pp. 204–210, 10 refs. Milan, March 1932. (With a Summary in German.)

In experiments made in 1931, silkworms [*Bombyx mori*, L.] were immunised against flacherie by being fed on mulberry leaves wetted with a vaccine prepared by grinding up in water silkworms that had died of flacherie. Similar immunisation was obtained in the case of polyhedral disease.

Manolache (C.). **Ueber das Auftreten des Getreidehähnchen *Lema melanopus* L. im Jahre 1931.** [On the Occurrence of *L. melanopa* in Rumania in 1931.]—*Pub. Soc. Nat. România*, no. 10, 1932, reprint 4 pp., 3 figs. Bukarest, 1932.

Lema melanopa, L., which is a well known pest of oats in Rumania, attacked them so severely in the spring of 1931 that in some localities they had to be ploughed under. The beetles were observed ovipositing on the leaves early in May. Larvae were seen on 20th May, and the resulting adults occurred from 12th June until the end of the month. Barley and maize were also attacked, the adults and larvae eating longitudinal strips between the leaf-ribs of the latter, and sometimes transverse strips if the leaf-tissue was tender.

Porremøllet og Løgfluen. [Leek Moth and Onion Fly.]—*Medd. Stat. Forsøgsvirks. Plantek.*, no. 199, 4 pp., 3 figs. Lyngby, March 1932.

Brief notes are given on the life-history and control of *Acrolepia assectella*, Zell., the most serious insect pest of leeks in Denmark, and *Hylemia antiqua*, Mg., which causes injury to onions.

Mayné (R.). **Rapport sur des essais de destruction de la mouche de la betterave.**—*Ann. Gembloux*, xxxviii, no. 4, pp. 164–168. Brussels, April 1932.

An account is given of experiments in 1931 against *Pegomyia hyoscyami* var. *betae*, Curt., which has recently shown increased activity in several localities in Belgium. In a field test with beet seedlings having 4–5 leaves, the application of nicotine, 1 : 500, with soap killed only about 50 per cent. of the larvae, the spray not penetrating sufficiently into the mines. A test of sodium fluosilicate in baits for the adult flies was rendered inconclusive by rain. Satisfactory results were obtained by the application in June to infested foliage in various localities of a bait spray consisting of 20 lb. sugar, 3–4 lb. sodium fluoride and 100 gals. water at the rate of about 6½ gals. to the acre, most of the flies being killed in two days. The solution was still adhering well to the foliage 6–7 days after application, but the success of the treatment depends on the absence of rain.

Buisman (C. J.). **Verslag van de phytopathologische onderzoekingen over de iepenziekte, verricht in het laboratorium "Willie Commelin Scholten" gedurende 1931.** [Report on the phytopathological Investigations on Elm Disease conducted in the "W. C. Scholten" Laboratory in 1931.]—*Tijdschr. Plantenziekt.*, xxxviii, no. 2, pp. 17–36. Wageningen, February 1932. [Recd. April 1932.]

This paper deals with artificial infection experiments in Holland with *Graphium ulmi* and various species and varieties of elms. This fungus was always to be found in the frass in the mines of the bark-beetle, *Scolytus scolytus*, F., in infected elms [*cf. R.A.E.*, A, xviii, 177, etc.].

Schoen (C.). **Bestrijding van Wantsen in eitoestand.** [The Control of Bugs in the Egg-stage.]—*Tijdschr. Plantenziekt.*, xxxviii, no. **3**, pp. 41–59. Wageningen, March 1932.

Continuing investigations in Holland on the control of the Capsids, *Plesiocoris rugicollis*, Fall., and *Lygus pabulinus*, L., infesting apple, large-scale tests were made in 1930–31 with the modified Long Ashton tar-distillate wash produced in Holland under the name of Capsokrimp [*R.A.E.*, A, xix, 249] and with a mixture of Capsokrimp and Winter Volck oil, because experiments in England had indicated that a mixture of a tar distillate and a petroleum product gives a wash of wide utility [xviii, 626; xix, 247]. Observations were also made on the effect of these insecticides in mixed orchards. Capsokrimp at 6 per cent. strength destroys the eggs of Aphids on plum, and 8 per cent. kills those of Lepidoptera on various plants, but 10 per cent. is needed for Capsid eggs and so must be used in mixed orchards. This concentration is not dangerous if, when budding has begun, spraying is done only when the temperature is as high as possible. The reason for this freedom from injury at high temperatures is not known. No difficulty was found in emulsifying Capsokrimp with hard or salt water, but it must be protected against frost, or some oil separates out, and the resultant solution may injure the plants. The combined spray was made with 5½ per cent. Capsokrimp and 7½ per cent. Volck.

A detailed account is given of the experiments made with these and some other washes. Capsokrimp was effective against the eggs of Capsids on apple, but the combined spray was superior, as it destroyed them on bush-fruits as well, which Capsokrimp alone did not. The reason for this is unknown, but the fact has been observed in England also. The results were constant with different varieties of apple. The mixture of Capsokrimp and Volck was not successful against mites; better results were obtained by spraying with 8 per cent. fruit-tree carbolineum followed by 7½ per cent. Volck. The control of mites, however, will be dealt with in a subsequent article. Some injury was caused by the Capsokrimp-Volck mixture to plums. This injury occurred usually in the lower branches, which remain wet longest, and thus confirms the advantage of rapid drying.

Lindeijer (E. J.). **Een bacterie-ziekte van de wilg.** [A bacterial Disease of the Willow.]—*Tijdschr. Plantenziekt.*, xxxvii, no. 3, pp. 63–67. Wageningen, March 1931. **Een bacterie-ziekte van de wilg (II.).** [A bacterial Disease of the Willow (II.).]—*Op. cit.*, xxxviii, no. 1, pp. 9–11, 1 pl. January 1932. [Recd. April 1932.]

The first of these papers deals with a disease of willows in Holland which was first reported in England by W. R. Day, who described the causal agent as a new species, *Bacterium salicis*. The second paper gives further particulars of the disease, the transmission of which is ascribed to *Cryptorrhynchus lapathi*, L. The mines of this weevil occurred in many diseased willows, with distinct evidence in some cases of the introduction of the bacterium, and surveys in various parts of Holland showed the weevil always to be present near diseased willows. In view of the spread of the disease, efforts should be made to control *C. lapathi*.

Zacher (F.) & Kunike (G.). **Verschleppung von Mehl- und Getreideschädlingen durch gebrauchte Säcke.** [The Spread of Pests of Flour and Corn by used Sacks.]—*Mitt. Ges. Vorratsschutz*, viii, no. 2, pp. 17–20. Berlin, March 1932.

Flour mills that have been freed of infestation with grain and flour pests by fumigation with hydrocyanic acid gas become infested anew, so that the treatment must be repeated every two years. The reintroduction of these pests by their own powers of flight is very slight, but carriage in grain and particularly in grain sacks is important. A detailed account is given of the examination of used sacks obtained from a flour mill in Berlin. In these, living individuals of a number of the usual insect pests of flour were found, and the need for fumigating such sacks is evident.

Böhme (—). **Bekämpfung der Dörrobstmotte.** [The Control of the Dried Fruit Moth.]—*Mitt. Ges. Vorratsschutz*, viii, no. 2, pp. 24–26. Berlin, March 1932.

Sulphur dioxide has been used in Germany as a fumigant against the dried fruit moth [*Plodia interpunctella*, Hb.], but though effective in empty store-rooms, it is not always so when goods are present. A non-inflammable proprietary fumigant, Areginal U [apparently a preparation of carbon tetrachloride] was tested, being allowed to act for 14 days in a store-room packed with goods. Subsequent ventilation required 4 days to be complete, and no moths were observed during the following 3 months on fly-papers placed in the fumigated room.

Hähne (H.). **Die Drehherzkrankheit des Kohles und der Kohlrüben.** [The Deformed Heart Disease of Cabbages and Swedes.]—*NachrBl. deuts. PflSchDienst*, xii, no. 4, pp. 25–27, 14 refs. Berlin, April 1932.

In view of the serious occurrence of the injury to cabbage known as deformed heart in various parts of Germany in 1931, experiments against the insects responsible for it are planned. As a basis for this work, the conditions of its occurrence and various possible methods of control are described. It is usually considered in Europe to be due to a gall-midge, *Contarinia torquens*, de Meij., but similar injury in England has been ascribed to *C. nasturtii*, Kieff. [*R.A.E.*, A, iii, 500]. The specific identity of the midge is not, however, considered to be of practical importance.

Klemm (M.). **Nochmals : Wirtschaftliche Bedeutung des Apfelblütenstechers.** [A further Note on the economic Importance of the Apple Blossom Weevil.]—*NachrBl. deuts. PflSchDienst*, xii, no. 4, pp. 27–29, 3 diag. Berlin, April 1932.

Previous observations in Berlin [*R.A.E.*, A, xviii, 628] on the economic importance of the apple blossom weevil [*Anthonomus pomorum*, L.] were continued in 1931, and several thousand reports from German growers were examined. It is again concluded that the weevil does not decrease the apple crop [but *cf.* xx, 7]. The reports from Wurttemberg show that the findings obtained at Berlin hold good for southern and western Germany, contrary to the view expressed by Trenkle [xix, 615].

Zacher (F.). **Das Auftreten des Speisebohnenkäfers in Deutschland.** [The Occurrence of *Bruchus obtectus* in Germany.]—*NachrBl. deuts. PflSchDienst*, xii, no. 4, p. 29. Berlin, April 1932.

Previous data had indicated that *Bruchus* (*Acanthoscelides*) *obtectus*, Say, could only become established in the warmer parts of Germany [*R.A.E.*, A, xix, 158], but it has now been found as far north as the neighbourhood of Eisleben, Central Germany, infesting beans in the field.

Amtliche Pflanzenschutzbestimmungen. [Official Regulations on Plant Protection.]—*NachrBl. deuts. PflSchDienst*, Beilage, iv, no. 2, pp. 47–74. Berlin, 1st April 1932.

This issue includes regulations directed against the introduction of the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] into Germany from France, which are in general similar to, but more stringent than, those in force in England [*R.A.E.*, A, xix, 657] ; and rules for the use in Germany of ethylene oxide as an insecticide.

Petch (T.). **Notes on Entomogenous Fungi.**—*Trans. Brit. Mycol. Soc.*, xvi, pt. 1, pp. 55–75, 4 figs. Cambridge, September 1931. [Recd. April 1932.]

The species dealt with include *Metarrhizium anisopliae*, the systematic position and characters of the spores of which are discussed, and which attacks a large variety of insects ; *M. album*, sp. n., on *Cicadella* (*Tettigoniella*) *spectra*, Dist., on rice, *Oospora insectorum*, sp. n., on an Aleurodid and other Arthropods, and *Cephalosporium* (*Agrostalgmus*) *aphidicola*, sp. n., on Aphids, all from Ceylon ; *C. crassum*, sp. n., on *Pentalonia nigronervosa*, Coq., from the Philippines ; and *O. ovorum* on eggs of *Schistocerca gregaria*, Forsk. (*Acridium peregrinum*, Ol.).

In temperate climates entomogenous fungi are commonly regarded as species that grow on insects in the ground or in decaying wood, and this view is supported by accounts of the larger species of *Cordyceps* occurring in the tropics. By far the greater number of fungi in the tropics, however, grow on insects attached to living foliage some distance from the ground, this being true not only of those that attack Coccids, but also of those that infest flies, wasps, ants and cockchafers. In order to make a representative collection of entomogenous fungi in a given district it is necessary to examine the under surfaces of leaves.

Garbowski (L.). **Sur les Entomophthorées. 1.** *Empusa aulicae* **Reich. en relation avec les ravages causés dans les forêts de Posnanie et de Poméranie en 1923–24 par** *Panolis flammea* **Schiff. 2.** *Entomophthora* (*Tarichium*) *punctata* **sp. n. sur** *Phytonomus variabilis* **Hbst. et** *Entomophthora sphaerosperma* **Fresen. sur** *Pieris brassicae* **L.** [*In Polish.*]—*Prace Wydz. Chorób Roślin państw. Inst. nauk.-roln. Bydgoszczy*, no. 4, pp. 1–24, 25–44, 5 maps, 29 figs., 20 refs. Bydgoszcz [Bromberg], 1927. (With Summaries in French, pp. 24 & 28.) [Recd. March 1932.]

In the first paper the history of outbreaks of the pine moth, *Panolis flammea*, Schiff., in Europe is briefly reviewed, with notes on the extent

of the area infested in Poland during 1922–1924 [*R.A.E.*, A, xvii, 493] and the losses caused. The important rôle played by *Empusa aulicae* in bringing this outbreak to an end is discussed. Examination of dead larvae collected in various districts showed the distribution of the fungus to coincide more or less with that of the moth. A description is given of its resting spores, which occurred together with the usual conidial form. In the laboratory, the conidia readily germinated in distilled water or a decoction of horse manure, as well as other media, and produced secondary and tertiary forms. Attempts made in 1925–27 to grow resting spores on different media after exposure to frost during the winter, or at room temperature and at 30°C. [86°F.], were unsuccessful, as were also experiments in infecting larvae of *Pieris brassicae*, L., *Malacosoma neustria*, L., and *Porthetria* (*Lymantria*) *dispar*, L., with them.

In the second paper *Entomophthora* (*Tarichium*) *punctata*, sp. n., is described from larvae of *Hypera* (*Phytonomus*) *variabilis*, Hbst., on lucerne in north-western Poland. The appearance of the diseased larvae is also described. A brief account is given of observations in the autumn of 1926 on the development of *E. sphaerosperma* in larvae of *P. brassicae*. The first conidia germinated better than those formed later. Attempts to induce resting spores to germinate on various media under ordinary temperature conditions and after exposure to frost were unsuccessful.

Obarski (J.). **Szkodnik róż i truskawek** *Cladius pectinicornis* **Geoffr. (Tenthredinidae, Hymenoptera).** [A Pest of Roses and Strawberries, *C. pectinicornis*.] [*In Polish.*]—*Choroby Roślin*, i, no. 3–4, reprint 10 pp., 3 figs., 1 pl., 23 refs. Warsaw, 1931. (With a Summary in German.)

An account is given of observations on the biology of *Cladius pectinicornis*, Geoffr., in 1930 and 1931 in a locality in central Poland, where this sawfly caused considerable damage to roses and strawberries. All its stages are described, with notes on its distribution. As it frequently occurs together with *C. difformis*, Panz., characters differentiating the adults of these two species are given. There are usually two generations a year, though three occurred in 1931. The larvae hibernate in cocoons in dry leaves on the ground, and the adults begin to emerge between the end of April and the second half of May, according to the temperature. They live for 14–18 days. Oviposition takes place on the upper surface of the pedicels [*cf. R.A.E.*, A, xvii, 676], about 40 eggs being laid singly by a female in cuts made in the epidermis. The larvae hatch in 10–12 days and at once migrate to the lower surface of the leaves, which they skeletonise. After about a month, they spin cocoons on the lower surface of the leaves or among dry leaves on the ground, pupating 7–10 days later. The adults emerge in about a fortnight. Larvae and adults are found throughout the summer. If the autumn is warm, feeding may last till about mid-October, but it usually ceases at the end of September.

Young larvae may be controlled with a spray of 30 per cent. nicotine sulphate, 1 : 200, and older ones with a spray of 1–1¼ lb. Paris green and 2–2½ lb. lime to 150 gals. water, or a 3–5 per cent. dust of Paris green and lime.

About 30 per cent. of the larvae were parasitised by the Ichneumonid, *Mesochorus confusus*, Hlmgr. (*cimbicis*, Ratz.).

[Bogdanov-Kat'kov (N. N.).] **Богданов-Катьков (Н. Н.). Entomological Excursions to Vegetable Gardens and Cucurbit Fields (Field and Laboratory Studies).** [*In Russian.*]—Demy 8vo, 528 pp., 393 figs., numer. refs. Moscow, Gosud. Izd. sel'skokhoz. kolkh.-koop. Lit. [State Pub. Agric. Co-oper. Lit.], 3rd edn., 1932. Price 5 *rub.* Binding 60 *kop.*

This is a considerably enlarged edition of a book already noticed [*R.A.E.*, A, xiv, 390] that dealt only with pests of crucifers, and contains notes on the bionomics of a large number of pests occurring in the Russian Union on all kinds of vegetables. Chapters are included on cultural, chemical, mechanical and biological methods of controlling them, with notes on spraying and dusting machinery. The pests are divided according to the seasons in which they occur, and are dealt with under the crops infested, remedial measures being briefly indicated in each case. Other sections of the book contain instructions for observations on the bionomics of insects and the extent of damage they cause, and for the collection and preparation of specimens. Keys are given to the chief pests of the various crops, based on the part of the plant attacked and the character of the injury. A separate chapter is devoted to the morphology of the eggs of the chief pests, the manner in which they are laid and the site of oviposition, with a key in which the eggs are distinguished by these characters. An exhaustive list of the pests arranged in systematic order with their food-plants, and indices to authors, subjects, insects and plants are appended.

[Nikol'skiĭ (V. V.) & Radzievskaya (S. B.).] **Никольский (В. В.) и Радзиевская (С. Б.). The Pink Bollworm.** *Earias insulana* **Boisd., Spotted or Spiny Bollworm.** [*In Russian.*]—Roy. 8vo, 40 pp., 13 figs., 36 refs. Roy. 8vo, 15 pp., 4 figs., 20 refs. Moscow, Ob'edin. Gos. Izd., Sr.-Az. Otd. [Union State Pub., Cent.-Asiat. Sect.], 1931. Prices 1 *rub.* 25 *kop.* and 50 *kop.*, respectively.

Detailed information, based entirely on the literature, is given on the biology, geographical distribution, parasites and control of *Platyedra* (*Pectinophora*) *gossypiella*, Saund., and *Earias insulana*, Boisd., all stages of which are described, in view of the possibility of the introduction of these moths into the cotton growing areas in the Russian Union [*cf. R.A.E.*, A, xvii, 125; xix, 77, 78]. *P. gossypiella* has not been found in the Union, but *E. insulana* was recorded in 1930 from the Nakhichevan district in southern Transcaucasia.

[Lyubishchev (A. A.).] **Любищев (А. А.). On the Problem of Calculation of the Amount of Damage caused by injurious Insects.** [*In Russian.*]—*Plant Protection*, viii (1931), no. 5–6, pp. 472–488. Leningrad, 1932.

The author discusses the different ways in which losses are caused owing to infestation of crops by insect pests and the chief methods of estimating the extent of the damage. The analytical method, in which the numbers of the insect concerned, the period of its activity and the local conditions are taken into consideration, tends to overrate the importance of an infestation and underestimate the resistance of the plants and the beneficial effect which certain pests sometimes exercise on the latter. The statistical method, which is based on data obtained from different districts on the injury caused by a given pest, is considered to be more reliable. The extent of the damage caused to

cereals in the Russian Union in 1930 by the summer crops Noctuid [*Apamea nictitans*, L.], cereal beetles [*Anisoplia* spp.], the Hessian fly [*Mayetiola destructor*, Say], the frit fly [*Oscinella frit*, L.] and the winter crops Noctuid [*Euxoa segetum*, Schiff.] is discussed. On the basis of reports from various districts, chiefly in European Russia, and of previous records (for 1923 and 1924), the author concludes that the yearly losses caused throughout the Union by all these pests averages about 3–4 per cent. of the crops. Though severe damage is sometimes caused in certain districts by *E. segetum* and in the Ukraine by *M. destructor*, the economic importance of these and other pests has been overrated.

[Rukavishnikov (B. I.).] **Рукавишников (Б. И.). The Work of the experimental Expedition of the Institute for Plant Protection on the Control of Pests of Sugar Beet in 1930.** [*In Russian.*]—*Plant Protection*, viii (1931), no. 5–6, pp. 489–513, 5 graphs, 2 refs. Leningrad, 1932.

A detailed account is given of experiments carried out in the summer of 1930 in the Ukraine on the control on beet of the meadow moth [*Loxostege sticticalis*, L.] and the beet weevil [*Bothynoderes punctiventris*, Germ.] with arsenicals and fluorine compounds. In the laboratory, feeding the weevils for two days on beet leaves dusted with sodium fluosilicate at a rate equivalent to about 7 lb. to the acre caused a mortality of 71·5 per cent. in 8 days, as compared with 67·1 per cent. in the case of Paris green applied at the same rate, and 76·8 per cent. in that of calcium arsenite at the rate of about 4½ lb. to the acre. In field tests on a small scale with sprays against *L. sticticalis*, the percentages of larvae killed in 5 days were about 64 with 1 per cent. sodium fluosilicate or sodium fluoride, 53·6 with 0·5 per cent. Paris green, and 59·2 and 33·2 respectively with 0·4 and 0·8 per cent. calcium arsenate. In view of the toxicity of the fluorine compounds, which caused practically no injury to the foliage, attempts should be made to manufacture them in the form of fine dusts that could be applied by aeroplane.

Calcium arsenite applied by aeroplane or a hand duster proved to be the most effective of the arsenicals tested. At the rate of about 4 lb. to the acre, a mortality of 82–84 per cent. was obtained against *L. sticticalis* and one of 44–55 per cent. against *B. punctiventris*. Larger quantities of dust scorched the leaves severely and decreased the rate of mortality of the former, probably owing to a repellent effect. When there was little or no dew and 4 lb. dust was applied to the acre, scorching did not exceed 10 per cent. of the leaf surface of mature plants, but was severe in the case of seedlings and very young plants. The unsatisfactory results obtained against *B. punctiventris* were probably largely due to the effect of cold, rainy weather, when the weevils did not readily feed and a considerable amount of the poison was washed off. Calcium arsenate at rates varying from about 6 to 7 lb. to the acre killed 83·9–90 per cent. of *Loxostege* when applied by aeroplane, and 69·9 per cent. by a hand duster. In the case of the beet weevil, the figures were 20–25 per cent. (55 per cent. in one instance only) and 30–40 per cent. respectively. Slight scorching occurred only in a few instances, when the dew was extremely heavy.

The effect of wind and ascending air currents on aeroplane dusting is discussed; some of the dust is always carried away. This loss may

be estimated at 20–40 per cent. for calcium arsenite, 30–75 per cent. for calcium arsenate and about 90 per cent. for Paris green. The costs of dusting by aeroplane and a hand duster are compared, and the advantages of the former method pointed out.

[Zhukovskiĭ (A. V.).] **Жуковский (А. В.). The Causes which determine the Infestation of Summer Crops by *Oscinella frit* L.** [*In Russian.*]—*Plant Protection*, viii (1931), no. 5–6, pp. 514–530, 11 refs. Leningrad, 1932.

Observations were carried out in 1928 on *Oscinella frit*, L., attacking barley, oats and summer wheat in the Voronezh Government, where it has three generations a year and its presence renders impossible the successful cultivation of these crops in the northern districts. All stages were found throughout the summer, but the adults were most numerous about 25th May, 10th July and mid-August. The egg, larval and pupal stages of the first generation lasted 6, 20 and 14 days respectively, and those of the second 4, 13 and 6 days. The eggs of the first generation are laid on summer crops, those of the second chiefly on grasses and such shoots of summer crops as are of no economic importance, and those of the third, which hatched in 10 days, chiefly on self-sown cereals and also on winter crops sown about mid-August, whereas those sown at the end of the month or later escape infestation. Observations showed that the eggs are usually laid between the leaf sheath and the stem, rarely on the leaf blade. Varieties of barley with leaf-sheaths closely adhering to the stems were less infested than those with loosely fitting ones, the severity of the infestation of a crop being in direct proportion to the number of plants having a space between the leaf sheath and the stem. As the plants develop, the leaf sheath gradually dries up, and more eggs are laid on the leaves and stems, chiefly those that are of no economic importance. In an experiment in which the leaf sheaths were artificially bent away from the stems of oats, 30–40 per cent. of the latter became infested; when, however, they were protected by a layer of soil, the rate of infestation did not exceed 6·2 per cent. From 60 to 75 per cent. of the eggs laid on the stems and leaves are usually destroyed by various factors, while the larvae that hatch from eggs laid on the soil die before reaching the plants. The fact that self-sown plants, chiefly on the edges of a field, were more infested than the actual crop, indicates that seeds germinating on or near the surface of the soil tend to produce plants with leaf-sheaths that do not adhere to the stem. Moreover in field experiments in 1929, oats were not attacked when sown at a depth of about 3 ins., whereas infestations of 2 and 7 per cent. occurred in those sown at depths of $1\frac{3}{4}$ and $\frac{7}{8}$ in. respectively; the corresponding figures for summer wheat were 49, 55 and 61 per cent., and for barley 26, 56 and 93 per cent. The slight retardation in certain phases of development of the plants observed in cases of deep sowing is of no appreciable importance.

[Chigarev (G.).] **Чигарев (Г.). On the Method of Soil Disinfection in the Control of Scarabaeid Larvae in Forestry.** [*In Russian.*]—*Plant Protection*, viii (1931), no. 5–6, pp. 534–547. Leningrad, 1932. (With a Summary in English.)

An account is given of experiments with various soil fumigants against Lamellicorn larvae in an old pine forest near Kiev in the summer

of 1931. The character of the soil is described, and differences in the conditions of soil fumigation under forest cover and in open areas exposed to the sun are discussed. It was found that the temperature of the surface of the soil averaged 9°C. [16·2°F.] higher in open areas than in the forest, while at a depth of about 5 ins. the difference was 8°C. [14·4°F.]. Moreover in a forest the temperature of the soil varies with the density of the trees, and their roots and the presence of undergrowth affect the action of the fumigants in the soil. The treatment should therefore be modified accordingly.

The fumigants were placed at a depth of 4–6 ins. in holes dug with a spade, and the treated areas examined three months later. Paradichlorobenzene killed all the larvae in an open glade when placed in holes about 20 ins. apart at the rate of 40 gm. [? to the square metre], as compared with 81·8 per cent. (99·4 per cent. when the holes were 10 ins. apart) in shady parts of the forest. "Polychlorides" [a mixture consisting chiefly of ortho-, meta-, and para-dichlorobenzene (*cf. R.A.E.*, A, xix, 111)] applied at the rate of 60 gm. in an open space covered with turf in holes about 10 ins. apart killed 99·2 per cent. of the larvae, and 99·5 per cent. in a plot covered with low undergrowth but devoid of trees when the holes were about 20 ins. apart and the dosage doubled. Orthodichlorobenzene in holes 20 ins. apart in plots with high grass vegetation and few trees killed 92·4 per cent. when applied at the rate of 40 gm., and 98·7 per cent. at 80 gm., and calcium cyanide applied at the rate of 60 gm. in an open glade in holes about 20 ins. apart killed 93·5 per cent., but the high cost in Russia of these two preparations prohibits their use. Carbon bisulphide at the rate of 60 gm. applied under various conditions did not give a mortality exceeding 90·7 per cent.

On the basis of these experiments, the author recommends for fumigating forest soil the use of paradichlorobenzene and polychlorides, at the rate of 40 and 60 gm. respectively, in holes about 10 ins. apart in the case of the former fumigant, and 13 ins. in that of the latter. Should the distance between the holes be increased to about 20 ins., the optimum dosage for polychlorides would be 70–80 gm.

[Sokanovskiĭ (B.).] **Сокановский (Б.). Results of the Use of Paradichlorobenzene against** *Melolontha* **Larvae in the Conditions of Moscow District.** [*In Russian.*]—*Plant Protection*, viii (1931), no. 5–6, pp. 548–551. Leningrad, 1932.

The properties of paradichlorobenzene and previous work in Russia on its application against Lamellicorn larvae are briefly reviewed [*R.A.E.*, A, xvi, 293; xvii, 306; xviii, 240]. Similar experiments in the second half of July 1930 in a pine forest near Moscow against the larvae of *Melolontha hippocastani*, F., are described. In the experimental plot, which was situated on open elevated ground with sandy soil covered with turf, as many as 125 larvae were found to the square metre, most of them at a depth of about 10 ins. Paradichlorobenzene was applied by hand in square holes about 20 ins. apart and about 5 ins. deep, 9 gm. being evenly distributed at the bottom of each hole and well covered with turf. Examination of the soil in September of the following year showed no trace of the beetle, whereas in the adjoining untreated plot infestation averaged 61·6 larvae to the square metre. As some of the fumigant was still present in the holes, equally good results might have been obtained with a smaller quantity.

[Troshanin (P. G.).] **Трошанин (П. Г.). How the Heaps of Pine Twigs left in the Forest for the Summer Season influence the Breeding of injurious Insects. (A Contribution to the Method of Registration.)** [*In Russian.*]—*Plant Protection,* viii (1931), no. 5–6, pp. 552–556. Leningrad, 1932.

An account is given of investigations in the Tartar Republic (former Kazan Government) in the summer of 1928, on the presence of bark-beetles in twigs and branches left in heaps in a pine forest after the felling of the trees. It was found that *Myelophilus* (*Blastophagus*) *minor,* Htg., occurred chiefly on the shady side of the felled area, whereas *Ips acuminatus,* Gyll., preferred the sunny side. Both species, which are important forest pests in this region, preferred branches about 3½ ins. in diameter, though they also occurred in those about 1–2 ins. thick. The broods in mother galleries in the thicker branches were larger. Estimates of the number of galleries and size of the broods produced indicate that the number of young beetles that may emerge from 100–175 cu. ft. of heaped branches would be sufficient to infest severely one standing tree. Heaps of branches should therefore be removed or burnt before 1st May.

Small numbers of *Ips* (*Pityogenes*) *bidentatus,* Hbst., were also found in these branches.

[Vereshchagin (V. A.).] **Верещагин (В. А.). A Note on the injurious Elaterid Beetles of the Far East Area.** [*In Russian.*]—*Plant Protection,* viii (1931), no. 5–6, pp. 557–559. Leningrad, 1932.

Of the wireworms found in the former Amur Province in the summers of 1930 and 1931, 82·4 per cent. were *Corymbites* (*Selatosomus*) *latus,* F., the larvae of which were abundant in fields of cereals and vegetables. In the laboratory, larvae of *Harminius dauricus,* Mannh., collected in the field in mid-May readily fed on potato tubers and sprouting seeds of maize, soy beans and wheat, and young adults appeared in the beginning of July; in nature they are on the wing till the beginning of August. The males are easily trapped at lights. The injury caused by Elaterids to cereals does not usually exceed 8–10 per cent., a higher rate of infestation occasionally occurring in limited areas.

[Rekach (V. N.).] **Рекач (В. Н.). Studies on the Biology and Control of the Corn-seed Maggot** (*Chortophila cilicrura* **Rond.).** [*In Russian.*]—*Trud. Zakavk. nauchno-issled. khlopk. Inst.* [*Trans. Transcauc. Cotton Sci. Res. Inst.*], no. xvi, 26 pp., 14 figs., 20 refs. Tiflis, 1932. Price 80 *kop.* (With a Summary in English.)

Considerable damage to cotton, leguminous plants and cereals in Azerbaijan is sometimes caused by *Phorbia* (*Chortophila*) *cilicrura,* Rond., which has also been recorded in the Russian Union from the Ukraine, northern Caucasus, Daghestan, western Siberia and Uzbekistan. All stages are described, and an account is given of observations on its biology, carried out in 1927 near Gandzha (Elizavetpol), where it has four partial generations a year, which overlap, hibernation occurring in the adult, larval or pupal stage. Some of the

pupae of each of the first three generations enter a diapause and hibernate.

The adults appeared in the beginning of March and were especially abundant in May, but only pupae were present in the field in July and August. The flies are active during the day in moderately warm weather, hiding in crevices in the ground when it is hot, cold or windy. The pre-oviposition period varied from 13 to 32 days or more, depending on temperature and nutrition. Under artificial conditions, the adults lived 25–30 days on an average, and a few as long as 53 days ; hibernating flies lived 4–5 months. Eggs were laid in cracks in loose, damp soil, preferably in soil that had been manured with cotton meal or was rich in decomposing organic matter. They were never found in dry, unploughed fields. Irrigation of cotton fields, which usually precedes sowing by 5–7 days, produces specially favourable conditions for oviposition, which lasts about 4 days. The larvae hatch in 2–11 days and immediately burrow into the soil, usually to a depth of about 2 ins. They cannot survive under dry conditions. The larval period usually lasts 9–13 days, or over three months in the winter. The larvae are polyphagous, and a list is given of over 20 cultivated plants that they readily attack ; they also feed on organic matter in the soil, especially decaying plant tissues. The damage they cause to germinating seeds and seedlings, in the stems of which they bore, is discussed. Pupation usually takes place at a depth of about 4 ins. in the soil, and occasionally in seeds. The pupal period lasts 9–14 days, or several months in the case of a diapause. Adults hibernate in crevices in the ground or under stones or lumps of soil, but become active on warm days. In Azerbaijan, the larvae hibernate exclusively in fields of winter crops, either in the soil or on the roots of cereals, and may pupate in any of the winter months if it is warm enough, or in March. The adults are preyed upon by spiders, and the larvae and pupae by birds and the Staphylinids, *Creophilus maxillosus*, L., and *Bledius tricornis*, Hbst. In 1927, about 4·5 per cent. of the pupae were killed in the spring by a fungus disease, and about 27 per cent. by a Staphylinid of the genus *Aleochara*.

Of the control measures tested, trap pits about 10 ins. deep and a yard square at the bottom proved the most effective. One should be dug to each half acre and partly filled with water, with which a mixture of 20–30 lb. cotton meal and 10–15 lb. earth is then stirred to make a uniform mass spread in an even layer. This layer is periodically watered during the following 3 weeks. The earth delays decomposition of the meal and reduces the cost. These traps attract the ovipositing females, and the resulting larvae may be destroyed by flooding the pits or pouring into them boiling water, crude oil, or a 3 per cent. solution of sodium arsenite. A bait of Paris green and cotton meal (1 : 25) broadcast and harrowed at the rate of about 30 lb. to the acre one day before sowing gave a mortality of 30–48 per cent., similar baits with other arsenicals being somewhat less effective.

Cotton-meal manure should only be applied in the autumn and should be immediately ploughed in. Fields should be ploughed in autumn and again early in spring to destroy weeds, which, if ploughed in later, will provide suitable conditions for the development of the larvae. If the flies are numerous in the spring, the fields should only be irrigated some time after sowing, to delay the appearance of the larvae until the seeds have sprouted. Winter crops sown as late as November in dry soil escape infestation.

[Vorontzovskiĭ (P. A.).] **Воронцовский (П. А.). Ecological Conditions of the Habitat of *Locusta migratoria* in the lower Delta of the Amu-Darya.** [*In Russian.*]—*Trud. Kompl. Nauchn.-Issled. Inst.* [*Trans. Complex Sci. Invest. Inst.*], Sect. Biol., Div. Ent., pt. 1, 34 pp. Turtkul, 1931.

The beds of reeds (*Phragmites communis*) in the lower delta of the Amu-Darya on the Sea of Aral provide regular breeding areas for *Locusta migratoria*, L. The actual areas where egg-laying is possible are restricted by conditions of soil humidity, dependent mainly on seasonal floods. The hatching of hoppers usually coincides with the beginning of the spring floods, pairing with the highest water and egg-laying with the falling of the water level. The hoppers spend almost all their life amongst reeds standing in water, and the usual control methods are, therefore, impracticable, the use of aeroplanes offering the only possible solution.

Bodkin (G. E.). **Entomological Service.**—*Rep. Palestine Dept. Agric. For. 1927–30*, pp. 48–55. Jerusalem, 1931. [Recd. March 1932.]

The most injurious pest of *Citrus* in Palestine is the Coccid, *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.), though it does not occur in the south of the country. During 1926 and 1927, fumigation with hydrocyanic acid gas resulted in mortality of 98 to 99 per cent. of the Coccids, and fumigation of the fruit prior to despatch to the interior of Egypt was also practised. The treatment of 300 trees with calcium cyanide dust showed this method to be as successful as the pot method. Fumigation work has been extended in subsequent years, but the equipment in use is quite inadequate to keep the Coccids under control, as every tree in a badly infested district requires fumigation every year. It is hoped that the work will eventually be handed over to private fumigation companies who will operate under Government control. *C. aurantii*, Ckll. (red scale) is increasing in southern Palestine, and either fumigation with hydrocyanic acid gas or spraying will have to be undertaken. Almonds are severely damaged by the Buprestid, *Capnodis carbonaria*, Klug. In consequence of orders given under the Plant Protection Ordinance, 1924, about 39,000 beetles were collected and about 9,000 trees, killed by the borers, were destroyed in the Jaffa district in 1929 and 1930. *Lymantria destituta*, Stdg., which feeds on the leaves of almonds, is also being studied with a view to control. Apricots, which constitute a very valuable crop, are chiefly damaged by *Cerambyx dux*, Fald. The larva first enters the bark of dead wood and continues to work on half-dead and weakened wood or on the bark of quite healthy wood, sometimes causing the death of the tree. Only neglected and sickly trees are attacked. Against *Dacus oleae*, Gmel., on olives the usual bait-sprays were employed, but although a weak solution was used, severe scorching of the foliage occurred, probably in consequence of some local condition of high temperature or dryness. In experiments for the control of *Ceroplastes rusci*, L., on figs, various concentrations of lime-sulphur spray against the hibernating adults before the foliage appeared were without value, and the results obtained with oil sprays during the period of full foliage when the overwintering scales were producing larvae did not warrant their use. Fumigation with hydrocyanic acid gas in November, on days with low temperature and little wind, gave very good results, 96·2 per cent. of the scales being killed on an area containing 486 trees. *Polychrosis botrana*, Schiff., on

vines was controlled over a large area by four applications, at regular intervals, of lead arsenate spray, the first being given as soon as the buds appear. The bud moth, *Theresia ampelophaga*, Bayle, is also troublesome on vines.

The administration of the Plant Inspection Service is discussed, the most important pest intercepted during 1927 being the hibiscus mealybug [*Phenacoccus hirsutus*, Green] on mangos from Egypt. New orders under the Plant Protection Ordinance include the publication of field fumigation charges, the prohibition of the introduction of banana plants into Palestine and the exclusion of fruit infested with the codling moth [*Cydia pomonella*, L.].

GARDNER (J. C. M.). **Immature Stages of Indian Coleoptera (10) (Anthribidae).**—*Ind. For. Rec.*, xvi, pt. xi, pp. 327–334, 1 pl. Calcutta, 1932. Price 6*d*.

Among the larvae described is that of *Araecerus suturalis*, Boh., taken from fruits of *Aleurites fordi* and other trees.

QUINN (G.). **Fruit Trees, Vines and Vegetables. Proved Remedies for common Diseases.**—*J. Dept. Agric. S. Aust.*, xxxv, no. 7, pp. 741–750, 12 figs. Adelaide, 15th February 1932.

This is a popular account of the principal pests and diseases of these plants found in South Australia and of the remedies proved to be useful against them. Formulae and instructions for preparing sprays and poison bait and for tent fumigation with hydrocyanic acid gas are appended.

Parasites for the Control of Cabbage Butterfly.—*N. Z. J. Agric.*, xliv, no. 2, p. 121. Wellington [N.Z.], 20th February 1932.

Pieris rapae, L., which has only recently been observed in New Zealand [*R.A.E.*, A, xix, 619], is steadily extending its range over the North Island. Some 3,000 puparia of *Apanteles glomeratus*, L., which is one of its most important insect parasites, have been received from England through the Imperial Institute of Entomology, and this material will be used for breeding supplies for distribution.

UICHANCO (L. B.). **A handy Duster for the small Garden.**—*Philipp. Agric.*, xx, no. 10, pp. 647–649, 1 fig. Laguna, March 1932.

A 10 per cent. dust of calcium arsenate and air-slaked lime is effective in controlling many leaf-eating insects in the Philippines without injuring the foliage of the plants. On low-growing plants such as vegetables, it may conveniently be applied from a wide-mouthed bottle with a piece of fine-mesh cloth covering the mouth. The cloth should be loose enough to enable a cork to be inserted when the bottle is not in use, and tied round with galvanised wire. Such a bottle would also be useful for applying dust against *Heliothis obsoleta*, F. (*armigera*, Hb.) on tobacco, as it is difficult to reach the larvae with a machine duster.

TAKAHASHI (R.). **Aleyrodidae of Formosa, Part I.**—*Rep. Dept. Agric. Govt. Res. Inst. Formosa*, no. 59, 57 pp., 34 figs., 62 refs. Taihoku, Formosa, March 1932.

This revision deals with 60 species of Aleurodids known to occur in Formosa, a large proportion of which are new. A catalogue is given of

the food-plants, some 65 species belonging to 53 genera being known to be attacked.

Among the new species described are *Aleurotuberculatus* (gen. n.) *gordoniae* on camphor (*Cinnamomum camphora*), etc.; *A. guyavae* on guava; *Aleurolobus citri* on *Citrus*; and *Trialeurodes mori* on mulberry (*Morus alba*), etc. Among the species described by Singh [*R.A.E.*, A, xix, 467], *Aleurocanthus rosae* is considered a synonym of *A. spiniferus*, Quaint., which is very common on *Citrus* in Formosa, and *Aleurotrachelus psidii*, and *A. murrayae*, as well as *Tetraleurodes aucubae*, Kuw. [xvi, 538], of which only *A. psidii* occurs in Formosa (on guava and camphor, etc.), are transferred to the new genus *Aleurotuberculatus*.

DOZIER (H. L.). **Descriptions of new Trichogrammatid (Hymenoptera) Egg Parasites from the West Indies.**—*Proc. Ent. Soc. Wash.*, xxxiv, no. 3, pp. 29–37. Washington, D.C., March 1932.

In Haiti the golden yellow strain of *Trichogramma minutum*, Riley, was reared in numbers from eggs of *Alabama argillacea*, Hb. (cotton leaf worm), a yellow strain from the foliage of red bean and sweet potato, and an almost brown strain, which possibly represents a distinct species, from eggs of *Calpodes ethlius*, Cram., on *Canna*, an outbreak of which was controlled by it. Numerous females of *Megaphragma mymaripenne*, Timb. [*R.A.E.*, A, xix, 471] were bred in Haiti from leaves infested by a species of *Microthrips*. It is thought that this parasite might be of use against *Hercothrips* (*Heliothrips*) *fasciatus*, Perg., particularly in the southern part of its range. Among the six new Trichogrammatids described is *Ufens osborni* reared from the eggs of *Diaprepes abbreviatus*, L. (sugar cane root weevil) in Porto Rico.

GILLIATT (F. C.). **Life-history and Habits of the Three-lined Leaf Roller, *Pandemis limitata* Rob., in Nova Scotia.**—*Sci. Agric.*, xii, no. 8, pp. 506–521, 3 pls., 8 refs. Ottawa, April 1932.

A detailed account is given of the bionomics of *Tortrix* (*Pandemis*) *limitata*, Rob. (three-lined leaf-roller) in Nova Scotia [*cf. R.A.E.*, A, xvii, 91; xix, 42], showing the seasonal history as observed particularly in 1927 and 1929. The stages are described. The larvae, having emerged from their hibernation quarters, feed on the interior of the young buds and later construct shelters by tying the margins of the leaves together. In the event of these being near newly formed fruit, the larvae feed on the surface making deep holes which scar the fruit and may cause it to drop prematurely. The larvae of the new brood cause the most serious damage, their feeding resulting in several small circular holes in the skin, the area around which becomes red or purple on exposure to the sun. This species has not been observed in epidemic form in Nova Scotia, and it appears that a companion species, the most important of which is *Eucosma* (*Spilonota*) *ocellana*, Schiff., is necessary for its increase in any given area.

CANADA. **Destructive Insect and Pest Act. Regulation No. 10 (Domestic).**—*A.O.R.* no. 8, Suppl., 1 p. Ottawa, 29th March 1932.

On account of *Taeniothrips gladioli*, Moult. & Stein. (gladiolus thrips), which has been responsible for severe damage in eastern Canada but

has not yet been found in British Columbia, the importation into that Province of *Gladiolus*, including all parts of the plant, from other parts of Canada is prohibited.

List of Intercepted Plant Pests.—*S.R.A., P.Q.C.A.* [1931], pp. 201–368. Washington, D.C., U.S. Dept. Agric., P.Q.C.A., March 1932.

This is the thirty-seventh of a series of lists of pests intercepted on imported plants and plant products in the United States, Hawaii and Porto Rico. The present list covers the period 1st January 1930–30th June 1931, and completes the lists of interceptions for a period of 18 years.

Severin (H. C.) & Gilbertson (G. I.). **Destroy the Grasshopper Eggs.** —*Bull. S. Dakota Agric. Expt. Sta.*, no. 267, 14 pp., 8 figs. Brookings, S. Dakota, October 1931. [Recd. April 1932.]

In view of the enormous amount of damage to farm crops by grasshoppers in South Dakota in 1930 and 1931 and the fact that large numbers of eggs are known to have been deposited in the infested areas, farmers are urged to make every effort to destroy as many of them as possible. Some 112 species of grasshoppers are known to occur in South Dakota, the important ones being *Melanoplus bivittatus*, Say, *M. differentialis*, Thomas, *M. femur-rubrum*, DeG., and *M. mexicanus*, Sauss. The life-cycle of these is outlined, the favourite sites for egg deposition are described, and the method of turning up clumps of grass or bare soil to find the eggs is explained. Fields infested with eggs should be disked and dragged several times at intervals of 10 days both lengthwise and crosswise ; and deep ploughing will bury the eggs effectively if the soil is not sandy and is well packed at the time they hatch. Land planted with maize should be thoroughly disked and harrowed in late autumn, and grain stubble, if not so treated in autumn, should be deeply ploughed in autumn and thoroughly disked and harrowed early in the following spring.

Lathrop (F. H.) & Nickels (C. B.). **The Biology and Control of the Blueberry Maggot in Washington County, Maine.**—*Tech. Bull. U.S. Dept. Agric.*, no. 275, 76 pp., 14 pls., 30 figs., 20 refs. Washington, D.C., February 1932.

A summarised account is given of extensive investigations carried out from 1925–29 in eastern Maine on the biology and control of *Rhagoletis pomonella*, Walsh, on blueberries (*Vaccinium canadense* and *V. angustifolium*). This Trypetid is apparently indigenous to the New England region and became troublesome with the increasing commercial importance of the blueberry crop ; it is now probably present in most of the important blueberry producing areas of the United States, constituting a threat to the development of this industry. As a result of the damage in the field, the berries are difficult to handle and require additional treatment before canning, and any larvae that are not removed by the washing process render the product unsaleable. The account of the biology of *R. pomonella* is similar to that already given [*R.A.E.*, A, xii, 7, etc.], and the information on control measures, which consist of the application of calcium arsenate dust and a periodical burning of the land, has already been noticed [xviii, 645 ; xix, 555].

Bratley (H. E.). **The Oleander Caterpillar, *Syntomeida epilais*, Walker.**—*Florida Ent.*, xv, no. 4, pp. 57–64, 2 pls., 6 refs. Gainesville, Fla., March 1932.

Syntomeida epilais, Wlk., is a pest of oleander (*Nerium oleander*), which is one of the chief ornamental plants in Florida, and also lives on the native food-plant, *Echites umbellata*. The period required for development varies considerably according to the season, but the average durations for the different stages are 4 days for the egg, 28 for the larva, 5 for the prepupa, 19 for the pupa and 9 for the adult; or an average of 60 days for the life-cycle, with a minimum of 30 and a maximum of 108. The eggs are deposited in groups of 12–75 on the lower surface of the leaf, and the larva feeds on the leaves, sometimes causing complete defoliation. No parasites of this Syntomid have been discovered, and entomogenous fungi and bacterial diseases only slightly reduce its numbers. Sprays do not spread or adhere on the waxy foliage of the oleander, and therefore dust, applied liberally when the foliage is dry, has given the best results. Calcium arsenate, or 1 lb. lead arsenate or Paris green to about 4 to 7 lb. of hydrated lime, have all proved effective, applications being made about every 30 days in summer or every 90 days in winter.

W[atson] (J. R.). **A Rose Chafer attacks Citrus.**—*Florida Ent.*, xv, no. 4, p. 70. Gainesville, Fla., March 1932.

The Melolonthid, *Macrodactylus angustatus*, P. de B., which is generally rare in Florida, appeared in February 1932 in enormous numbers on *Citrus* in one grove, the beetles causing great damage to the young and tender foliage, buds and blossoms.

Studies of Insect Pests.—*44th Ann. Rep. S. Carolina Expt. Sta. 1930–31*, pp. 63–73, 3 figs. Clemson Coll., S.C., December 1931. [Recd. April 1932.]

The Japanese beetle [*Popillia japonica*, Newm.] has been discovered in South Carolina, where four living beetles were taken at Charleston in bait traps. In studies on maize pests, by O. L. Cartwright, further data for purposes of comparison were obtained on the life-history of *Diatraea crambidoides*, Grote (*zeacolella*, Dyar), since those previously recorded [*R.A.E.*, A, xix, 313]; additional food-plants found were *Sorghum* and the grass, *Paspalum scrobiculatum*. *Sphenophorus* (*Calendra*) *callosus*, Ol. (corn billbug) was shown to be able to live for two years and oviposit throughout the two growing seasons.

F. Sherman has experimented with the Mexican bean beetle [*Epilachna corrupta*, Muls.] by placing hibernation cages containing 500 beetles, one in a very sheltered situation in a wooded ravine and another in an exposed situation on the top of a hill; 33 per cent. of the beetles in the former emerged but only 2 per cent. of those in the exposed position. As the midsummer weather in South Carolina often reduces the numbers of the beetle to a great extent and much of the damage is done by the overwintered adults, hibernation conditions are evidently of the greatest importance. Emergence lasted from mid-May to mid-June, but the large majority emerged during the three weeks following 21st May. Showers in April and May seemed to stimulate emergence, but the evidence on this point is not conclusive. A map shows the eastward spread of this beetle during 1931.

W. C. Nettles, studying the oriental fruit moth, *Cydia* (*Laspeyresia*) *molesta*, Busck, found that peaches again [*cf. loc. cit.*] escaped serious injury. In 1931 this may be attributed to high sunset temperatures (above 85°F.) during June and July, which retarded oviposition, and also to the activities of the parasite, *Macrocentrus ancylivora*, Rohw., introduced in 1930, which was responsible for 95 per cent. of the parasitism of this species recorded for the year. A larva [*Epiblema strenuana*, Wlk.] that bores in the stems of ragweed and serves as winter host for *M. ancylivora* in New Jersey has been found in South Carolina and has probably helped the parasite to survive the winter. Another parasite, *Glypta rufiscutellaris*, Cress., has been introduced from New Jersey, but has not yet been recovered in the field. The incidence of the various generations of the codling moth [*Cydia pomonella*, L.] is recorded for the year. The variation in life-history makes an annual study necessary in order that sprays may be properly timed. Parasitism of the first generation eggs by *Trichogramma minutum*, Riley, only amounted to 17·4 per cent. (less than one-third the number in succeeding generations), and it is suggested that if liberations could be made when first generation eggs are most abundant, the control of the moth would be greatly increased. Preliminary studies of this parasite by O. L. Cartwright and W. C. Nettles indicate that there are only slight differences in form or developmental periods between the Ohio and South Carolina strains, but there is a noticeably higher fecundity in the South Carolina strain.

J. G. Watts found seedling cotton to be attacked by *Frankliniella tritici*, Fitch. Nine complete generations have been reared in the laboratory; the first four of which are present during the seedling stage of cotton. The average time required for the life-cycle was 14 days, ranging from 22 days in early spring to 9 in mid-summer. This thrips has also been found in the adult stage on cabbage throughout the winter, but it is not known whether it can develop continuously.

Wymore (F. H.). **The Garden Centipede.**—*Bull. California Agric. Expt. Sta.*, no. 518, 22 pp., 12 figs., 8 refs. Berkeley, Cal., November 1931. [Recd. March 1932.]

An account is given of the bionomics and control of *Scutigerella immaculata*, Newp. [*cf. R.A.E.*, A, xvii, 552; xx, 42, etc.], with particular reference to the infestation of asparagus in California, based on data obtained during 1922–31 [*cf.* xii, 578]. Its distribution is discussed, and the stages are briefly described. In the Delta region of the Sacramento river in California, the eggs may be found practically throughout the year, though they are most numerous during the latter part of April and in May. Moisture appears to be an important factor in egg production. A high percentage of the eggs hatch in the field; they are sometimes attacked by a fungus in the laboratory. The life-cycle lasts several months, and under laboratory conditions individuals have lived 9–10 months.

The Symphylids may be distributed in soil on farm tools or the roots of plants, and care should be exercised when moving manure to the field not to include the edges of the heap where the manure is well decayed and vegetation may be growing, as this material was found to be highly infested. The possibility of transport in the crowns of asparagus from the nursery or in boxes returning from the canning factory is considered unlikely.

Flooding has proved the most practical means of control if the fields are comparatively level and adjacent to an abundant supply of relatively cheap water [xii, 578]. The effects of flooding on the asparagus plants and the soil, and the cost during various years are discussed, and suggestions are made for the preparation of the fields for treatment. It should be carried out in the winter when the plants are dormant. If the dikes are constructed on infested soil, the Symphylids will migrate to them as the water rises, and they may become a source of re-infestation. In cases where this cannot be avoided, the application, while the water is on the field, of $2\frac{1}{2}$ oz. carbon bisulphide in holes 18 ins. apart and 1 ft. deep on the crest of the dikes and 2 oz. carbon bisulphide in holes 1 ft. apart on the side away from the water should destroy most of the Symphylids. Carbon bisulphide similarly used is also effective in controlling recently discovered infestations. Soil fumigants, including paradichlorobenzene and calcium cyanide, did not prove practical for general field treatment [*cf.* xii, 578; xiv, 406; xv, 194], and experiments with repellents gave negative results. Intensive cultivation of the soil has not controlled this pest. In the laboratory this Symphylid was attacked by four species of centipedes (Chilopoda).

Drake (C. J.), Harris (H. M.) & Tate (H. D.). **Insects as Vectors of Yellow Dwarf of Onions.**—*Science*, lxxv, no. 1943, pp. 341–342. New York, 25th March 1932.

Experiments carried out to ascertain the agent of dissemination in districts of Iowa of yellow dwarf, a virus disease of onions that caused a loss in 1928 of as much as 95 per cent. of the crop in some cases, showed that *Aphis rumicis*, L., and *A. maidis*, Fitch, were mainly responsible. Only a few cases of transmission were obtained with *Rhopalosiphum prunifoliae*, Fitch, and the Jassid, *Cicadula sexnotata*, Fall., although the latter is very common in the fields and readily feeds on onion. In more than 200 definite transmissions, the symptoms appeared on the plants on an average of 7–12 days after the initial exposure to infective Aphids. Regardless of the part of the plant to which the infected Aphids were confined, the first visible evidence of the disease invariably appeared in the new shoots.

Hansen (H. N.) & Davey (A. E.). **Transmission of Smut and Molds in Figs.**—*Phytopathology*, xxii, no. 3, pp. 247–252, 11 refs. Lancaster, Pa., March 1932.

Examination proved that mites and thrips are vectors of cryptogamic organisms capable of producing smut and moulds in figs in California [*cf. R.A.E.*, A, xvi, 320; xvii, 358], and that they enter long before the eye-scales of the figs begin to loosen. The presence of the larger insects, *Carpophilus hemipterus*, L., and *Drosophila melanogaster*, Mg. (*ampelophila*, Lw.), is not necessary for the occurrence of smut and moulds. The mites found in green figs were *Seius pomi*, Parrott, *Cheyletus* sp. and two unidentified species. They have been observed to feed on *Eriophyes fici*, Ewing, and are usually found in the eye region of the fig. *E. fici*, which was present in 90 per cent. of the figs examined is apparently insignificant as a carrier of cryptogamic organisms, but may be of considerable importance in attracting the predacious mites. The thrips found were *Frankliniella tritici*, Fitch, *F. californica*, Moult., *Thrips bremneri*, Moult., *Liothrips ilex*, Moult.,

Hercothrips (*Heliothrips*) *fasciatus*, Perg., and the predacious *Leptothrips mali*, Fitch. All the mites and at least two of the thrips, *F. tritici* and *L. mali*, breed in both edible figs and caprifigs and, with the exception of the last named, feed on the tender floral parts.

DUTTON (W. C.). **Spray Injury Studies I-II.**—*Spec. Bull. Michigan Agric. Expt. Sta.*, no. 218, 68 pp., 16 pls., 27 refs ; no. 219, 38 pp., 17 figs., 8 refs. East Lansing, Mich., January-February 1932.

The results are presented of observations on injuries caused to the trees in a series of experiments carried out in Michigan over a period of several years to determine the value of various materials and combinations of materials used for insect and fungus control in orchards. The first paper deals with injuries from summer applications on apples and discusses the types of injury caused by various forms of lime-sulphur, alone or in combination with lead arsenate, by various arsenicals, and by Bordeaux mixture ; the use of supplementary materials to reduce injury ; and the amounts of injury to foliage and fruit occasioned by different concentrations and various times and conditions of application. The second paper, which deals with the secondary effects of spray injury to apple foliage, submits evidence that indicates clearly the importance of the cumulative effects of spraying. Under certain unusual conditions fruit-set has been reduced. Heavy application, frequent application, high concentration, spraying heavily from under trees, and severe lime-sulphur scorching at the time of petal-fall are factors that may cause excessive loss of fruit in June. Even moderate amounts of injury to foliage affect unfavourably the formation of blossom buds, and fruit-set may also be reduced. The premature dropping of fruit just before the harvest period is often greater where considerable foliage injury has occurred, and the size of the fruit has also been unfavourably affected and colour development checked. The growth of wood, determined by measurement of annual rings, is checked where the leaf area has been reduced owing to injury caused by spraying.

HOWARD (L. O.). **The Insect Menace.**—Demy 8vo, xv+347 pp., 32 pls., text ill. New York & London, The Century Co., 1931. Price 12*s*. 6*d*. net.

The author describes the object of this interesting book as an attempt to arouse the public to an appreciation of the real and increasing menace to humanity that exists in the insect kingdom. The history and evolution of the various types of insects are traced from earliest times ; the natural advantages of insects in the struggle for survival and the impetus to their increase that is given by civilisation are described ; and the growing use of weapons of defence, including biological control, chemicals, aeroplanes, quarantines and variations in crop practices are discussed. To instance the great progress that has taken place during the last half century in the United States in the appreciation of the importance of taking adequate measures to combat dangerous pests, a comparison is drawn between the amount of funds and work expended on the Rocky Mountain locust [*Melanoplus spretus*, Uhl.] in 1873–76, and, from the commencement of outbreaks, on the Mexican boll weevil [*Anthonomus grandis*, Boh.] from 1894 onwards and the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] in 1929.

Hervey (G. E. R.). **The European Corn Borer in western New York.** —*Bull. New York St. Agric. Expt. Sta.*, no. 603, 28 pp., 7 figs. Geneva, N.Y., February 1932.

An account is given of work carried out from 1928 to 1931 in western New York on the seasonal history of *Pyrausta nubilalis*, Hb., on maize, and the effects of the time of planting and of ploughing on the rate of infestation, much of which has been recorded previously [*R.A.E.*, A, xvii, 270 ; xviii, 398 ; xix, 351]. Ploughing is equally effective when carried out in spring or autumn ; though migration is greater from material buried by treatment in spring, this does not appear to be significant, owing to the absence of shelter for the larvae at this time. In some types of soil, such as heavy clay, ploughing in spring is more advisable. The infested material should be buried at a sufficient depth to remain undisturbed during subsequent cultivation. The degree of protection obtained by delayed planting appears to be relative and is in general dependent on the abundance of the moth in any particular area and also on seasonal conditions. This method of control will probably not be feasible in the case of late maturing varieties or in areas where the growing season is short, but the first planting of maize grown for canning can be delayed until 1st June and in some cases longer.

Bartley (H. N.) & Scott (L. B.). **Preliminary Report upon the Infestation and general Status of the European Corn Borer in western New York.**—*Circ. U.S. Dept. Agric.*, no. 197, 22 pp., 8 refs. Washington, D.C., December 1931. [Recd. April 1932.]

In order to determine the progress of infestation by *Pyrausta nubilalis*, Hb., in western New York from 1920 to 1929 inclusive, very detailed field surveys have been made from year to year in representative maize fields in various localities. The earlier observations were made primarily to determine the extent and seriousness of the infestation, but later studies were intended to supply information concerning its progress. The infestation, when first discovered in 1919, covered an area of 25 sq. miles, but by 1926 practically the whole of New York State and half of Pennsylvania were involved.

Observations were made on ears, stubble and entire plants, studies of the ears being made for the most part in canning factories. Whenever possible, the sample used in estimating the degree of plant infestation amounted to 100 plants to the acre, equal numbers of consecutive plants being taken in the centre of each quarter and in the centre of the field.

The 1920 infestation was comparatively light and no commercial damage was noted ; but after 1921 the degree of infestation increased steadily until 1926 when approximately 67 per cent. of the plants in the area under observation were infested, the average infested plant containing 3·6 larvae. The rate of infestation increased from 65 larvae to 100 plants in 1921 to 242 larvae to 100 plants in 1926. In 1926 commercial damage was general, and special field inspectors and helpers at the sorting tables had to be employed, special field machinery being also required in treating infested ears. As a result of a campaign in 1927 the infestation dropped to approximately 197 larvae to 100 plants, and the decrease in ear infestation was reduced to 15 per cent. as compared with 25 per cent. in 1926. Since 1927, infestation has dropped steadily, and in 1929 it amounted approximately to 72 larvae to 100 plants, and about 6·6 per cent. of all the ears were found to be infested.

Although the observations do not indicate that any type or variety of maize is particularly susceptible to attack, it is evident that early planted maize, regardless of type and variety, is more severely attacked than that planted during late May or early June. Preliminary observations made during 1926 and 1927 indicated that approximately 15 full-grown larvae were produced from every 100 eggs deposited, the number varying slightly with the type of the maize and the size of the plant when the eggs hatch. A list is given of the food-plants of *P. nubilalis* recorded in western New York during the period discussed.

Chapman (P. J.) & Hammer (O. H.). **Apple Insects in the Hudson Valley and the Lake Champlain Fruit Districts.**—*Bull. New York St. Agric. Expt. Sta.*, no. 606, 32 pp., 12 figs., 3 refs. Geneva, N.Y., February 1932.

An account is given of investigations on five apple pests in eastern New York, carried out in 1931 as a basis for the development of spray programmes for use in the fruit districts of the Hudson Valley and Lake Champlain. Three applications of 3 lb. lead arsenate to 100 U.S. gals. spray (the first applied as a calyx spray, the second 7–10 days subsequently and the third in the first cover spray against *Cydia pomonella*, L.) gave a good commercial control of *Conotrachelus nenuphar*, Hbst. (plum curculio), reducing the marks of injury on the fruit by about 90 per cent. In experiments on a small scale against *Tachypterellus quadrigibbus*, Say (apple curculio) various sprays gave a certain degree of control, though it was shown that this weevil presents serious difficulties to the development of satisfactory measures by customary spray practices. The standard sprays did not prove effective. Fallen fruit should be disposed of by July.

The long growing-seasons and unusually warm weather during the period 1929–31 have probably been responsible for the increase of *C. pomonella* in these districts, and special efforts should be made to reduce the numbers that survive the winter. Further experiments on the control of *Rhagoletis pomonella*, Walsh (apple maggot) [*cf. R.A.E.*, A, xix, 403, 545] showed that equally satisfactory results can be obtained with 2–3 lb. lead arsenate to 100 U.S. gals. spray when used alone or in combination with lime-sulphur or other fungicides, the time of application depending on the period of emergence of the flies, which may vary in different years in the same locality. The systematic picking of fruits that drop at or before harvest should produce beneficial results. A spray of $\frac{1}{2}$–$\frac{3}{4}$ U.S. pint nicotine sulphate, 4–6 lb. potash fish-oil soap (66 per cent. water) and water to make 100 U.S. gals. is recommended for the control of *Typhlocyba pomaria*, McAtee (white leafhopper). If preferred, the soap may be omitted and the nicotine used with the standard spray mixtures. In the Hudson Valley in 1931, the treatment against the first brood coincided with the second application against *Conotrachelus nenuphar*. The sprays should be applied if examination of the under surfaces of the leaves after blossoming and again after the middle of August reveals an average of 4–5 nymphs to each leaf.

Schoene (W. J.). **Leafhoppers injurious to Apple Trees.**—*Bull. Virginia Agric. Expt. Sta.*, no. 283, 34 pp., 7 figs., 6 charts, 24 refs. Blacksburg, Va., January 1932.

An account is given of leafhoppers infesting apple in Virginia, chiefly based on observations during 1927–31. Four species, namely *Typhlo-*

cyba pomaria, McAtee, *Erythroneura harti*, Gill., *E. obliqua*, Say, and *E. lawsoniana*, Baker (*dorsalis*, Gill.) were found to be generally abundant, and *Empoasca fabae*, Harr., was observed on the rapidly growing terminals and is responsible for leaf curl. Much of the information has already been noticed from briefer papers [*R.A.E.*, A, xviii, 401 ; xix, 350]. Serious infestation has been found to occur in the same orchard each year. There is no evidence that there are definite migrations of *T. pomaria* or of the three species of *Erythroneura*. It is thought probable that frequent rains are unfavourable to the leafhoppers, since during periods of rainy weather they disappear from the foliage in the field, whereas in cages they continue to multiply.

Experiments showed that contact insecticides can be effectively applied during the period when the nymphs are present. The first brood of *T. pomaria* can be reduced in numbers by combining nicotine with one of the regular sprays. The time for applying the spray is regulated by the hatching of the eggs, which occurs between the petal-fall and three weeks' sprays. A special spray can be applied in August against the second generation. The nymphs of *E. harti* can be controlled by adding nicotine to the regular mid-summer spray. For a special spray directed only against the nymphs, 40 per cent. nicotine sulphate, diluted 1 : 1,200, should be combined with 1 per cent. summer oil.

Beamer (R. H.). *Erythroneura* **collected on Apple with Description of a new Species.**—*J. Kansas Ent. Soc.*, v, no. 2, pp. 62–64. McPherson, Kans., April 1932.

The following leafhoppers are recorded on apple : *Erythroneura dowelli*, sp. n., *E. lawsoniana*, Bak., and *E. omani*, Beamer, in Kansas and Arkansas ; *E. magnacalx*, Beamer, *E. vulnerata*, Fitch, *E. compta*, McAtee, *E. vitifex*, Fitch, *E. tricincta*, Fitch, *E. kanza*, Robsn., *E. basilaris*, Say, *E. affinis*, Fitch, *E. kansana*, Bak., and *E. omaska*, Robsn. (of which the last nine were only represented by a few individuals and were probably migrating forms) in Arkansas ; *E. electa*, McAtee, in Maryland ; and *E. volucris*, Beamer, in Pennsylvania.

Pettit (R. H.). **The Grape-berry Moth in 1932.**—*Quart. Bull. Michigan Agric. Expt. Sta.*, xiv, no. 3, pp. 167–170, 3 figs. East Lansing, Mich., February 1932.

Brief notes are given on the life-history of the grape berry moth [*Polychrosis viteana*, Clem.], a serious vine pest in Michigan. Since hibernation occurs in cocoons on the ground, ploughing the vineyard in the spring in order to bury them is recommended. This should be done early in order that the soil may become compact before the time at which the moths would emerge. In view of the fact that winter survival is greatest if shelter is available, débris and weeds should be removed and parts of the vineyard covered with a blanket of snow during the winter should be carefully watched [*cf. R.A.E.*, A, xvii, 373]. As methods of washing grapes to remove spray residue have not been developed to a high degree of efficiency and strict regulations on arsenical residue on all fruits in the United States will be put into effect in 1932, the application of heavy arsenical sprays late in the season should be avoided. Three of these sprays should be applied : one just before blossoming, another 10 days later, and the third at the time when the grapes reach $\frac{1}{4}$ in. in diameter.

McDaniel (E. I.). **Corn Earworm, *Heliothis obsoleta* as a Greenhouse Pest.**—*Quart. Bull. Michigan Agric. Expt. Sta.*, xiv, no. 3, pp. 183–186, 3 figs. East Lansing, Mich., February 1932.

Heliothis obsoleta, F., has recently caused severe damage in greenhouses in Michigan, particularly to geranium, rose, *Calendula* and chrysanthemum. The first complaints of injury were received about mid-September. As no larvae could be found in the soil, and the use of a poisoned bran bait did not reduce their numbers, they probably remained on the plants until they reached maturity.

Hutson (R.). **Tests show Way to control Raspberry Mites.**—*Quart. Bull. Michigan Agric. Expt. Sta.*, xiv, no. 3, pp. 191–193. East Lansing, Mich., February 1932.

Tetranychus telarius, L. (*bimaculatus*, Harv.), *Paratetranychus ilicis*, McGregor, and *T. mcdanieli*, McGregor [*R.A.E.*, A, xx, 85] have been causing injury to raspberries in Michigan during recent years. The leaves that are damaged by the mites drop off, and berries on severely infested plants do not ripen normally. Examination of canes from various plantations during the winter of 1930–31 showed that some of the mites hibernated at the bases of the buds and under the strips of loose bark, whereas contrary to what might have been expected, none was found to emerge from rubbish on the ground. This indicated that sprays could be applied before the leaves had developed to such an extent as to render thorough coverage difficult, and tests showed that 3 treatments at intervals of 5 days with 1 per cent. summer oil, applied alone or in combination with Bordeaux mixture as soon as the foliage begins to appear, will give satisfactory control. The oils did not injure the plants even when applications were made once a week for 9 weeks. Other successful sprays were nicotine and penetrol, derrisol and soap, and glue. Old canes should be cut down as soon as the fruit is picked and immediately burnt in order to prevent the mites from migrating, and alternative food-plants, particularly *Sonchus arvenis*, should be destroyed.

DeLong (D. M.). **Some Problems encountered in the Estimation of Insect Populations.**—*Ann. Ent. Soc. Amer.*, xxv, no. 1, pp. 13–17. Columbus, Ohio, March 1932.

Factors causing variation in the numbers caught in attempts to obtain representative samples of certain types of insects, such as leafhoppers, with sweep nets are discussed. The proportion of insects captured will vary greatly, even if one person does the sweeping and the population remains constant, their capture depending largely upon their reaction to certain stimuli, which vary in predominance or complexity. Many physical factors influence the rate or type of response and consequently the numbers in population samples. Temperature affects metabolic rate and the rapidity of " jump " reaction, and orientation appears to be closely correlated with temperature, although humidity may also be a factor. Under conditions of extreme temperature, or marked fluctuations during short periods, the insect apparently changes its position on the plant in response to the changing physical conditions, and may be found on the higher portions, near the surface

of the ground, or even below it at times. Height of sweeping, correlated with physical factors, is very important as regards both quantitative and qualitative population samples under any given complex of environmental factors. On the other hand, sweepings taken at different heights at the same time will give variable samples, particularly regarding the percentages of different species, which are frequently differently distributed upon a plant. A reaction that appears to depend mainly on increased humidity has been observed in the case of certain grass-feeding leaf-hoppers, which normally migrate to shrubs and taller plants for the night.

Other factors of importance are wind velocity and the position of the sun, both of which cause the insects to seek shelter, so that the position of the operator in regard to them will affect the number caught; the size and condition of the plant; and the rapidity and length of the stroke in sweeping. A backward stroke should immediately follow the forward stroke, as the first stroke often causes the insect to jump and the second catches it. The rate of migration into cultivated fields of insects habitually hibernating outside them is another important factor, the distance from a particular point in some cases determining the size of the sample. Farm practices may also effect local changes in insect populations, and migration may be caused by varying conditions of plants. It is almost impossible to secure by means of the sweep method any accurate information concerning the nymphal populations of leaf-hoppers.

Though owing to such factors as these, sweeping only gives a rough estimate with active insects such as leafhoppers, it is of undoubted value in obtaining qualitative data and in determining the relative predominance of species. Upon trees or taller types of vegetation the difficulties encountered can be avoided by using calcium cyanide dust [*R.A.E.*, A, xx, 38].

Hamlin (J. C.). **An Inquiry into the Stability and Restriction of Feeding Habits of certain Cactus Insects.**—*Ann. Ent. Soc. Amer.*, xxv, no. 1, pp. 89–120, 3 figs., 15 refs. Columbus, Ohio, March 1932.

In connection with the importation of American cactus-feeding insects into Australia for the purpose of combating species of prickly pear (*Opuntia*), it was considered essential to determine the stability of their feeding habits before liberating them in the new country.

The following is taken from the author's summary and conclusions drawn from an investigation carried out in the United States which dealt with the following species: the Coreids, *Chelinidea vittiger aequoris*, McAtee, *C. tabulata*, Burm, *C. canyona*, Hamlin, and *Narnia pallidicornis*, Stål; the Coccid, *Dactylopius opuntiae*, Ckll. (*tomentosus*, auct.); the Pyralids, *Olycella junctolineella*, Hulst, and *Mimorista flavidissimilis*, Grote; and the Lamiid, *Moneilema crassa*, Lec. The insects are shown to be closely restricted to the Cactaceae, *D. opuntiae* having the closest restriction and *C. vittiger aequoris* the greatest degree of adaptability to economic plants. The various degrees of restriction are based upon one or more factors, of which the more important are the physiological adjustment of the insects to cactus; the biological requirements of continuously available food-plants; the biological requirements of the physical conditions provided by cactus, especially those of the subgenus *Platyopuntia*; and plant reaction to insect attack. Newly-hatched larvae of the cactus insects are less adaptable

to new food-plants than the more mature individuals. Fruits such as the fig and peach provided the most satisfactory food of the series of 35 economic plants tested.

Although the climatic conditions of eastern Australia from the coast toward the interior parallel in a general way the climatic changes encountered from the Gulf coast of Texas to Arizona, there may be factors operating in the new environment that may permit of a change in food habits on the part of some of the insects, but such eventualities are extremely remote and not amenable to experimental determination. The peculiarities of cactus, which mark it as a distinctly isolated botanical group, afford the greatest degree of safety possible in the importation of plant-feeding insects for the biological control of noxious vegetation, and the general isolation of the genera of cactus-feeding insects from the other genera of major groups indicates a high degree of specialisation.

From published researches, it is evident that a considerable number of varied factors may determine the restriction of feeding habits of different types of phytophagous insects. Thus, whereas instinctive selection by adults of many species in connection with oviposition is of great importance in preserving the food-habits of the insects, the availability of the plant with regard to the biology of the insect appears to operate as a check against erratic oviposition. It is concluded that the food-plant restriction of phytophagous insects may be determined by one or several of a number of factors, of which no one, nor any one group, is of constant dominance.

VANCE (A. M.). *Microgaster tibialis* **Nees as a Hymenopterous Parasite of** *Pyrausta nubilalis* **Hubn. in Europe.**—*Ann. Ent. Soc. Amer.*, xxv, no. 1, pp. 121–135, 1 pl., 1 fig., 14 refs. Columbus, Ohio, March 1932.

Microgaster tibialis, Nees, all stages of which are described in detail, is a rather important solitary parasite of *Pyrausta nubilalis*, Hb., in several parts of Europe. The young stages of the host larva are attacked, the female depositing an egg within the body cavity of the small borer and the parasite larva passing three stages internally before issuing to spin a cocoon.

Although generally distributed in Europe, *M. tibialis* has been found of greatest economic importance as a parasite of *P. nubilalis* in the one-generation area of northern France. The average parasitism for the eight-year period 1922–1929 inclusive in the region of Paris was 29·7 per cent., with maxima of 63·2 and 52·5 per cent. in 1925 and 1926 respectively; for the six-year period 1924–1929 inclusive in the environs of Lille, the average parasitism equalled 16·4 per cent. In the two-generation area of *P. nubilalis* in the Po Valley, the average parasitism of the first generation near Bergamo for the seven-year period 1924–1930 inclusive was 5·7 per cent. In these and other localities where studies have been made, the degree of control by *M. tibialis* has shown considerable fluctuation.

This parasite has been collected in large numbers from European areas, and shipments containing a total of 587,062 cocoons have been made to the United States over the period 1923–1930 inclusive. *M. tibialis* hibernates in the pupal stage within its cocoon, and in the one-generation area in northern France the adult emerges in April and May and oviposits about July. The spinning of the cocoon takes place in

October. In the Po Valley of Italy, where two generations of the host occur, two broods of the parasite develop on *P. nubilalis*.

Hyperparasites reared from the cocoons of *M. tibialis* in northern France were *Gelis fraudulentus*, Frst., *G. instabilis*, Frst., *G. acarorum*, L., *Stictopisthus laticeps*, Thoms., and *Mesochorus tuberculiger*, Thoms. Another hyperparasite from the same region was tentatively determined as *Pimpla* (*Epiurus*) *brevicornis*, Gr.

Sweetman (H. L.). **The Effects of Temperature and Moisture on the Distribution of the Mexican Bean Beetle,** *Epilachna corrupta*, **Muls.** *Ann. Ent. Soc. Amer.*, xxv, no. 1, pp. 224–240, 4 pls., 15 refs. Columbus, Ohio, March 1932.

Previous work in the attempted experimental determination of the limits of temperature and moisture affecting *Epilachna corrupta*, Muls., is discussed in detail [*R.A.E.*, A, xiii, 246; xvii, 365; xviii, 492; xix, 208, 211, 613; xx, 218]. Among various methods of analysis of the natural environment, by which the practical value of laboratory work can alone be determined, the climograph method of Ball, by which moisture can be plotted against temperature, was found to be of value. Cook [xii, 49] adopted a curve representing the optimum temperature and precipitation for the insect studied, superimposed on the climograph as a standard of comparison of climatic conditions in different areas. Humidity is considered to be a better measure for use than precipitation, since the moisture of the environment in laboratory experiments is usually recorded as relative humidity. Maps showing the average annual precipitation, and prevailing direction and average velocity of winds, as well as temperature and moisture conditions prevailing in the United States, are given. On this basis the author divides the United States into five regions according to the climatic conditions prevailing, and by means of correlating these with the known distribution of *E. corrupta*, estimates its probable future distribution and abundance.

Metzger (F. W.) & Grant (D. H.). **Repellency to the Japanese Beetle of Extracts made from Plants immune to Attack.**—*Tech. Bull. U.S. Dept. Agric.*, no. 299, 21 pp. Washington, D.C., March 1932.

During a period of three years, 474 extracts of 390 different plant species, belonging to 326 genera and 108 families, were tested as repellents to the Japanese beetle, *Popillia japonica*, Newm. The machinery and methods used in preparing the extracts are described as well as the method of application to the trees. Only 56 of the extracts gave any indication of repellency, and most of them were less repellent than preparations of derris or pyrethrum. A list is given of 22 plant extracts that showed some degree of repellency on small peach and apple trees, some of which might be tested more extensively, and a botanical classification is appended of all the plants extracted, the solvent used and the part of the plant employed being given in each case.

Buchanan (L. L.). **The Parsley and Carrot Weevil,** *Listronotus latiusculus* **Boheman.**—*Bull. Brooklyn Ent. Soc.*, xxvii, no. 1, pp. 7–8, 6 refs. Brooklyn, N.Y., February 1932.

For several years a weevil of the genus *Listronotus* has been recorded damaging parsley and carrots in the east and middle west of the United

States. It has been identified by different authors as *L. latiusculus*, Boh., and *L. rudipennis*, Blatch. [*R.A.E.*, A, xii, 365; xiv, 451; xvi, 265], but examination of about 175 specimens, including reared material from the four authors referred to, indicates that there is but one extremely variable species that occurs over a wide area in the United States and Canada. The more conspicuous modifications are given; for the most part they appear to be purely individual and merge into one another through intergrading examples. The author suggests the adoption of the name *L. latiusculus* until the original type has been examined, although various statements in the description of the latter would seem to suggest another species, in which case the name *rudipennis* would be available for the carrot weevil. Confusion in the past has been due to Professor Weed's record of the rearing of *L. latiusculus* from *Sagittaria*, a marsh plant unrelated to the dry land Umbelliferae [*cf.* xiv, 451], but examination of his original specimen has shown it to be *Hyperodes solutus*, Boh.

Powell, jr. (T. E.). **Fumigation and Cigarette Beetles. A Correction.** —*Ecol. Monog.*, ii, no. 3, reprint 1 p., 1 ref. Durham, N.C., June 1932.

In a paper recently noticed [*R.A.E.*, A, xx, 170] there occurred errors that gave wrong impressions of the relative values of fumigants used in experiments with cigarette beetles [*Lasioderma serricorne*, F.]. Owing to the use by the author of concentrated sulphuric acid and sodium cyanide (from which gases other than hydrocyanic acid are produced), instead of a mixture of sulphuric acid, water and sodium cyanide, the entire section devoted to hydrocyanic acid gas is incorrect, and has no bearing upon its effectiveness as a fumigant for *L. serricorne*. A further error applies to all statements concerning all the other fumigants, including carbon bisulphide, ethylene oxide, and carboxide, in connection with which the amounts per 1,000 cu. ft. stated should in each case be multiplied by 4·86.

Barrett (R. E.). **An annotated List of the Insects and Arachnids affecting the various Species of Walnuts or Members of the Genus *Juglans* Linn.**—*Univ. California Pub. Ent.*, v, no. 15, pp. 275–309, 5 pp. refs. Berkeley, Cal., 29th March 1932.

The information contained in this paper was collected for the purpose of drawing attention to the pests of trees of the genus *Juglans*, with particular reference to those attacking *J. regia* (Persian or English walnut). A total of 68 families, 233 genera and 338 species and varieties are dealt with, the families being arranged in phylogenetic order and the genera and species in them alphabetically. Notes are given on their distribution throughout the world and on the manner in which they cause damage.

Walker (H. G.). **Insecticidal Value of certain Pyrethrum Extracts.**—*Bull. Virginia Truck Expt. Sta.*, no. 75, pp. 943–971, 1 fig., 9 refs. Norfolk, Va., April 1931. [Recd. April 1932.]

A detailed account is given of experiments during 1929–30 to determine the value of certain pyrethrum extracts as insecticides, the following being taken from the author's summary: Only a few of the 50 varieties of plants tested showed any evidence of foliage injury by

pyrethrum soap sprays even at the strong concentrations used. The toxic properties of oleoresins extracted by various solvents from uniform lots of pyrethrum flowers as determined by tests on insects indicate that alcohol, acetone, and ethylene dichloride are about equally effective in extracting the active principles, and that benzene and petroleum ether are not as efficient as these. Different insects reacted differently to various wetting agents, but in general, the soaps, with the exception of triethanolamine oleate soap, gave better results than the oils. In the case of the larvae of *Tenebrio molitor*, L., however, triethanolamine oleate soap gave the best results.

The toxic properties of oleoresins stored alone and in combination with a coconut oil soap for a period of 11 months were not appreciably different. An oleoresin of pyrethrum in combination with a coconut oil soap with a pH of 9·5 retained its toxic properties for at least a month, whereas a similar mixture with a pH of 12 lost practically all its toxicity within 12 hours. Although rather inconclusive, other tests indicated that any factor or set of factors at the temperatures used (75–85°F.) that has a tendency to dry off insects sprayed with a pyrethrum soap mixture tends to decrease the resulting mortality.

Newcomer (E. J.) & Yothers (M. A.). **Experiments with Insecticides for Codling-moth Control.**—*Tech. Bull. U.S. Dept. Agric.*, no. 281, 28 pp., 7 figs., 9 refs. Washington, D.C., February 1932.

The more important results of laboratory and orchard experiments in controlling *Cydia* (*Carpocapsa*) *pomonella*, L., with sprays conducted at Yakima, Washington, from 1919 to 1929 inclusive are brought together in this paper with a view to meeting the demand for more effective methods that will not leave objectionable spray residues.

The following is taken from the authors' summary : The use of lead arsenate at 2 lb. to 50 U.S. gals., or of an increased number of applications at 1 lb. to 50 U.S. gals., improved the control, but also resulted in more arsenical residue. A casein spreader in small quantities caused the lead arsenate to be somewhat more effective, but in larger quantities it did not have this result. Fish-oil also increased the effectiveness of the lead arsenate, but made residue removal more difficult. Soap, glue, and flour paste reduced the value of the lead arsenate. None of 13 other arsenicals tested controlled *C. pomonella* so well as lead arsenate, and several of them damaged apple fruit or foliage severely. Barium arsenate, zinc arsenate and manganese arsenate were the most effective. Lubricating oil sprays proved to be valuable against the eggs, and they also had some toxic effect on eggs deposited a few days after spraying, but did not repel ovipositing moths and had little effect on the larvae. Heavy or relatively unrefined oils were often injurious to the foliage or fruit. Oil sprays alone were not so efficient as lead arsenate.

It was concluded that in order to use oil safely and effectively, a medium oil with a Saybolt viscosity of 65 to 75 seconds and a large proportion of unsulphonatable residue should be added in a proportion of slightly less than 1 per cent. to not more than three or four lead arsenate cover sprays. Nicotine sulphate was somewhat toxic to the eggs and larvae of *C. pomonella* in warm weather, but by itself was of less value than lead arsenate. Of the materials tested to prevent too rapid volatilisation of the nicotine, lubricating oil gave the best results,

and very good control was obtained with a combination of nicotine sulphate, diluted to 1 : 800 or 1 : 1,600, and 1 per cent. lubricating oil. This combination is of value when substituted for lead arsenate in one or more cover sprays. Poor results were obtained with crude dipyridyl sulphate and crude benzyl pyridine. Derris, in the forms tested, was ineffective, and pyrethrum extracts were effective only for a short time after being applied.

Hodson (W. E. H.), Staniland (L. N.) & Beaumont (A.). **Eighth Annual Report of the Department of Plant Pathology for the Year ending September 30th, 1931.**—*Pamph. Seale-Hayne Agric. Coll.*, no. 37, 25 pp. Newton Abbot, Devon, 1932.

Pests reported as causing considerable damage in Devon and Cornwall during the year include: *Kakothrips pisivorus*, Westw. (*Franklinella robusta*, Uzel) on pulse crops, *Atomaria linearis*, Steph., on mangels and sugar beet, *Psila rosae*, F., on carrots and parsnips, *Phorbia* (*Hylemyia*) *brassicae*, Bch., and *Ceuthorrhynchus pleurostigma*, Mrsh., on cabbage, etc., and *Lygus pratensis*, L., and Aphids on chrysanthemums. *Trialeurodes vaporariorum*, Westw. (greenhouse whitefly) was abundant. The cockroach, *Blatta orientalis*, L., destroyed quantities of sweet pea seed under glass. On the whole pests of fruit were of normal incidence.

Information given on the control of *Merodon equestris*, F. (large bulb-fly) has been noticed previously from a more detailed paper [*R.A.E.*, A, xix, 374].

A list is given of insects not recorded in the seven preceding years or occurring on food-plants not previously recorded. They include *Contarinia nasturtii*, Kieff., on rape, *Bourletiella hortensis*, Fitch, which occurred in enormous numbers on broccoli though it is doubtful if it caused any injury, *Acronycta rumicis*, L., on strawberry and apple, *Tarsonemus fragariae*, Zimm., on strawberry, *Otiorrhynchus sulcatus*, F., on chrysanthemum, *Myzus circumflexus*, Buckt., on arum lily, *M. persicae*, Sulz., which infested stored gladiolus but was controlled by fumigation with paradichlorobenzene, and *Amphidasys* (*Pachys*) *betularia*, L., on commercial willow-beds.

Thorpe (W. H.). **The primary Larvae of three Ophionine Ichneumonids, parasitic on** *Rhyacionia buoliana*.—*Parasitology*, xxiv, no. 1, pp. 107–110, 1 pl., 4 refs. Cambridge, 24th March 1932.

Descriptions are given of the primary larva of *Cremastus interruptor*, Grav., and *Omorgus mutabilis*, Holmg., which are Ichneumonid parasites of *Rhyacionia buoliana*, Schiff., in England [*cf. R.A.E.*, A, xix, 29]. As many as 4–5 larvae of the former may be found together in a single host, but only one reaches maturity, the others succumbing early in the first stage; when *C. interruptor* is found in association with the Braconid, *Orgilus obscurator*, Nees, the latter is invariably destroyed. Only one larva of *Omorgus mutabilis* can reach maturity in a single host. A primary larva, apparently that of *Eulimneria rufifemur*, Thoms., has also been examined, but as it seems indistinguishable in all reliable characters from that of *E. alkae*, Ell. & Sacht. (*crassifemur*, auct.), which has already been described [xviii, 369], the head alone is figured.

McDougall (R. S.). **Insect Pests. No. xiv.**—*Scot. J. Agric.*, xv, no. 2, pp. 184–191, 7 refs. Edinburgh, April 1932.

In this paper, which is one of a series [*cf. R.A.E.*, A, xx, 143], very brief notes are given on the larval characters and bionomics of some of the Dipterous pests of cereals in Britain, including the Hessian fly [*Mayetiola destructor*, Say], *Haplodiplosis equestris*, Wagn., and *Contarinia tritici*, Kby., all on wheat; *Oscinella frit*, L., on oats; and the gout-fly [*Chlorops taeniopus*, Mg.], on barley. *Hylemyia* (*Leptohylemyia*) *coarctata*, Fall., which is primarily a pest of wheat, is dealt with more fully [*cf. R.A.E.*, A, ix, 321; xvi, 298, etc.]. Since the eggs are laid in July and August on bare soil or soil with a very light cover, keeping the ground covered with vegetation in the summer before wheat is sown is suggested as a means of preventing oviposition. Suitable catch crops and crop rotations are discussed.

Stapel (C.). **Champignonskulturens Skadedyr.** [Insect Pests of Mushroom Beds.]—*Gartner Tidende*, 1932, reprint 6 pp., 6 figs. Copenhagen, 1932.

Springtails (*Hypogastrura* spp.) that attack mushrooms in Denmark are briefly described. The females oviposit in mushroom beds, preferably in the soil at about $\frac{1}{4}$ inch below the surface, the eggs being laid in masses of 10–40. Oviposition is repeated several times at intervals of 12–14 days. At 22°C. [71·6°F.] the eggs hatch in the course of 10 days, and in mushroom houses development is completed in 5–7 weeks, the maximum length of the life-cycle being one year. The conditions necessary for mushroom cultivation are most favourable to the springtails, which require easy access to living and rotting organic matter for nourishment. A mass occurrence, which is characteristic of their attack above ground, involves injury that spreads rapidly over a wide area. Although they have some difficulty in penetrating the mushroom, once they have broken through, they quickly render it unfit for sale, not only by boring, but also because their excrement causes it to putrefy.

The Phorid, *Megaselia* (*Aphiochaeta*) *albidihalteris*, Felt, so often recorded elsewhere as a pest, has not been observed in Denmark, but several Mycetophilids cause injury to mushrooms. The females oviposit in mushroom beds, in crevices on the soil surface. The eggs, which are laid in masses of 10–16, hatch in 4–5 days at room temperature, under which condition the life-cycle lasts about a month. As a mushroom culture takes 3–4 months to develop, it is possible for 3–4 generations of these flies to develop and build up a mass infestation. The larvae devour the mycelium in the manure and thus prevent growth, and also penetrate into the stem, and later the cap, of the mushroom. In addition to direct injury, the larvae cause much trouble by cutting up the manure and transforming it into a heavy, wet spongy mass, which offers poor growing conditions for mushrooms.

Various mites were present in almost every sample of manure from mushroom beds examined, *Tyroglyphus lintneri*, Osb., being the only species identified. Most of the damage caused by mites occurs in the soil, where they consume the mycelium and thus cause sterility or, if the attack is slight, produce malformation of the mushrooms often followed by infestation above ground. The extent of the damage caused by mites in Denmark is not definitely known, but in connection with

an attack by *Rhizoglyphus* sp., laboratory observations indicated that reproduction is effected with incredible rapidity. As in the case of Collembola, the mites collect in particular spots, either where mushrooms above them have previously been destroyed, or where they themselves have broken through, the infestation developing from these points.

Preventive measures against all these pests are of primary importance, and the numerous insects invariably present in the fresh horse manure that forms the foundation of the bed must be destroyed before the bed is laid down. This can best be effected by heating the manure, which will kill any eggs or larvae present, after which care must be taken that a secondary infestation does not take place. Where mushrooms have been previously cultivated in a house, not only must all the manure be removed, but the house itself must be thoroughly fumigated with calcium cyanide at the rate of 1½ oz. or burnt sulphur at the rate of 8 oz. per 100 cu. ft. of room space. If in spite of this, the insects become very numerous, control measures must be resorted to, although complete extermination is impossible as they can always take refuge in the manure. Those in the top layer, however, can be destroyed by treatment with effective materials. Those suggested include a 0·2 per cent. nicotine spray against the Mycetophilids, the ceilings and walls as well as the beds being treated if there is a mass infestation; and fumigation with paradichlorobenzene (5–6 oz. per 1,000 cu. ft. of space) against the springtails [*cf. R.A.E.*, A, xx, 303]. No experiments against mushroom mites have been carried out in Denmark.

Bovien (P.). **Om Aeblemarvmøllet** (*Blastodacna putripennella* **Zell.**) **og en ny Beskadigelse, foraarsaget af dette Skadedyr.** [The Pith Moth of Apple (*Blastodacna putripennella*) and a new Injury due to this Pest.]—*Tidsskr. Planteavl.*, xxxvii, pp. 743–751, 5 figs., 5 refs. Copenhagen, 1931. (With a Summary in English.) [Recd. April 1932.]

Peculiar mines found beneath the skin of apples in several localities in Denmark in October 1930 were caused by larvae that were indistinguishable from those of *Blastodacna putripennella*, Zell. The author considers that this moth is undoubtedly the same as that referred to by Miles as *B. atra*, Haw. [*R.A.E.*, A, xix, 135], but that further work is necessary before the correct name can be established. Injury of this type is known to be caused by *Enarmonia prunivora*, Walsh, but this moth is unknown in Denmark. The larvae under observation, with one exception, died after leaving the fruit. The remaining larva pupated, the pupa in every way resembling that of *B. putripennella*, but the adult did not emerge. As hibernating larvae of this moth have been known to produce in the laboratory lesions similar to those described, and since the injuries caused all occurred in localities where it is abundant, the identification is considered certain. Instead of hibernating normally under the bark, it is believed that these larvae penetrated the fruits and there developed to an unwonted size owing to abundant food.

A brief description of *B. putripennella* and its life-history is given. Oviposition was observed in the laboratory in the summer of 1930, the eggs being found on the lower surfaces of the leaves, mostly along the veins, and only a few on the leaf stalks and twigs [*cf. loc. cit.*]. In the course of further observations in orchards numerous eggs were found on the lower surfaces of the leaves.

Gautier (C.) & Bonnamour (S.). **Quelques observations sur** *Praon abjectum* **Hal. (Hym. Aphidiidae).**—*Bull. Soc. ent. Fr.*, xxxvii, no. 6, pp. 99–100. Paris, 1932.

The Braconid, *Praon abjectus*, Hal., is a common parasite of Aphids in the Lyonnais district of France, where examination has shown that it varies, chiefly in regard to size and the number of joints in the antennae, according to the food-plant of the unidentified Aphid hosts. The observations, which are recorded in detail, indicate that eventually different races of this Braconid may become specialised to their hosts, especially the one parasitising the rose aphis.

Balachowsky (A.). **Contribution à l'étude des coccides de France (6e note). Observations biologiques sur l'adaptation de** *Novius cardinalis* **Muls. aux dépens de** *Gueriniella serratulae* **F.**—*Rev. Path. vég. Ent. agric.*, xix, fasc. 1, pp. 11–17, 7 refs. Paris, January 1932.

Observations in the Alpes Maritimes, France, have confirmed the fact recorded by Bodenheimer in Palestine, that *Rodolia* (*Novius*) *cardinalis*, Muls., a predator hitherto believed to be specific to *Icerya purchasi*, Mask., against which it has been introduced into many countries in the Mediterranean region, is also able to feed on *Gueriniella serratulae*, F. Studies carried out in an arid district showed that this Coccid develops abundantly on herbaceous plants and moves when ready for oviposition to trees, in the bark of which the eggs are deposited, sheltered from the light. In 1930 this migration took place between the end of May and 15th June. On 9th June numbers of *R. cardinalis* were observed at different stages of development devouring the eggs of *G. serratulae*. Newly deposited eggs of *Rodolia* were also seen among masses of the Coccid eggs. By 8th July the numbers of the Coccinellid had considerably decreased, and most of the eggs of *G. serratulae* that remained intact produced larvae in a state of diapause by about 10th July. No further attacks on *G. serratulae* were observed after 26th July, but *R. cardinalis* was seen at this time and in the same locality, feeding on *Icerya purchasi* which was present here and there.

The Coccinellid has been reared with ease in the laboratory on the eggs of *G. serratulae*, which it devours as readily as those of *I. purchasi*. Although it also accepts larvae in diapause, it dies if fed exclusively on them before reaching maturity, and they are refused under field conditions. In captivity it may accept the eggs and larvae of other Monophlebines, but refuses all Coccids not of this subfamily. In nature it is only likely to attack *G. serratulae* during the short period between the deposition and hatching of the eggs, which occurs at the end of May and beginning of June, this Coccid having only one generation a year, and the larval diapause lasting several months without being influenced by external conditions. *I. purchasi* has several overlapping generations, the number and duration of which are dependent on climatic conditions, and in the Alpes-Maritimes eggs, larvae or young females are available for the Coccinellid throughout the entire period of its activity from May till November.

The adaptation of *R. cardinalis* to *G. serratulae* seems to depend on the attraction exercised by the mass oviposition of the Coccid and only manifests itself when three definite conditions are satisfied, *viz.*: the presence during the developmental period of the Coccid of abundant

herbaceous vegetation allowing of mass production ; lack of shelter, which forces the females to concentrate on a limited number of trees that therefore become covered with eggs ; and the simultaneous presence in the neighbourhood of foci of *I. purchasi*, constituting a reserve of *R. cardinalis*. It is therefore impossible to rely on this Coccid for acclimatising the Coccinellid in regions where it did not before exist. As, however, the distribution of the latter in France already considerably exceeds that of the former, it is unlikely that any attempt will be made in this direction.

SPEYER (W.). **Hat** *Cheimatobia brumata* **L. einen Hochzeitsflug ?** [Has *C. brumata* a nuptial Flight ?]—*Anz. Schädlingsk.*, viii, no. 4, pp. 37–38. Berlin, April 1932.

Definite cases are recorded from Germany in which pairing females of *Cheimatobia brumata*, L., were carried short distances in horizontal flight by the males. This is rare and quite unimportant as regards the infestation of tree crowns by the winter moth. Infestation of banded fruit trees is sometimes due to larvae from eggs laid below the bands, unless they are prevented from climbing by new ones applied in spring. Larvae can also be carried by wind from neighbouring trees.

GOFFART (H.). **Versuche zur Bekämpfung der Kohlfliege** (*Phorbia brassicae* **Bché.**) **mit Naphthalin.** [Experiments with Naphthalene against the Cabbage Fly.]—*Anz. Schädlingsk.*, viii, no. 4, pp. 44–45. Berlin, April 1932.

In experiments in North Germany naphthalene was applied as a repellent against *Phorbia brassicae*, Bch., on 15th–26th May 1931 on plots of cabbage, not later than 3 days after planting out. After 3 days, eggs of the fly were already present. An application of 7 oz. to 6 sq. yds. was made, and 10 days later $3\frac{1}{2}$ oz. The difference between treated and untreated plots was evident, especially where the naphthalene had been strewn round the plants instead of being broadcast. Just before harvest, the loss in treated plots was under 5 per cent. while that in untreated ones ranged from 20 to 30 per cent. Treated cabbages averaged $1\frac{1}{3}$ lb. more in weight, and they reached maturity earlier than untreated ones, probably owing to undisturbed growth. Naphthalene is uneconomic at the dosages given, but smaller quantities would probably suffice, and further tests are being made.

FUHR (—). **Versuche über Wurmbekämpfung ohne Arsen.** [Experiments in combating Vine-moths without Arsenic.]—*Deuts. Weinbau*, ix, 1930, p. 466. (Abstract in *Z. Pflkrankh.*, xlii, no. 5, p. 249. Stuttgart, 1932.)

In Germany an intimate mixture of 1 part potassium alum and 9 parts kaolin or hydrated lime has been found to kill in a few hours the young larvae of the spring and summer generations of vine-moths [*Clysia ambiguella*, Hb., or *Polychrosis botrana*, Schiff.]. Dusting must be done before distinct webs are visible and repeated 8 days later. No injury is caused to the vines.

Popović (J.). **Borkenkäferschäden in den Nadelholzwäldern des Drina- und Vrbas-Banates.** [Damage by Bark-beetles in the Conifer Forests of the Drina-Vrbas Banate.]—*Arb. phytopath. Anst. Sarajevo*, 1931, p. 57, 9 figs. [*In Serbian with German Summary.*] (Abstract in *Z. PflKrankh.*, xlii, no. 5, p. 251. Stuttgart, 1932.)

Conifers in unfavourable situations in the Drina-Vrbas district of Bosnia suffered severely from drought in June-August 1928 and were then infested by bark-beetles, especially *Ips typographus*, L., on spruce. In 1930 withered trees were felled and the infested bark burnt together with the twigs and branches in order to destroy *I.* (*Pityogenes*) *chalcographus*, L., and *Polygraphus poligraphus*, L. Even trees that became infested in 1930 were felled. As that year was cold and rainy, development from egg to adult sometimes lasted 10½–11 months. Silver firs [*Abies*] suffered less; their chief pests were *I. spinidens*, Rttr., *I. curvidens*, Germ., and *I. vorontzowi*, Jacobs. *Pinus sylvestris* was attacked only in the Kladanj area, the beetles concerned being *I. acuminatus*, Gyll., *I. sexdentatus*, Börn., and, in the branches, *I.* (*P.*) *quadridens*, Htg., and *I.* (*P.*) *bistridentatus*, Eich.

Powell (H. C.). **The Culture of the Orange and allied Fruits.**—Demy 8vo, 355 pp., 83 figs., 2 maps. Johannesburg, Central News Agency Ltd., 1930. Price 21*s.* net. [Recd. May 1932.]

This work includes a chapter of 24 pages devoted to a survey of the insect pests of *Citrus* occurring in South Africa, with an account of methods of fumigation with hydrocyanic acid gas and spraying. The classified bibliography includes sixty titles dealing with pests and fumigation.

Investigations on the Spike-disease of Sandal. IV.—16 pp. Bangalore, Indian Inst Sci., 1932.

An account is given by N. C. Chatterjee (pp. 9–15) of the progress made by the Forest Research Institute, Dehra Dun, in entomological investigations on spike disease of sandal [*Santalum album*] during the quarter ending 31st December 1931. As the result of transmission experiments it is now definitely proved that the weevils, *Sympiezomias cretaceus*, Faust, *Dereodus sparsus*, Boh., and *Myllocerus* sp., fed on sandal plants infected with spike disease and transferred to healthy ones produce a chlorosis of the leaves [*R.A.E.*, A, xix, 651; xx, 102] in a minimum period of 2½ days. Experiments with the Jassids, *Moonia variabilis*, Dist., of which *M. diversa*, Dist., was found to be the female, and *Petalocephala uniformis*, Dist., and an Issid, *Sarima* sp., have so far yielded negative results. Difficulties were experienced in rearing *Tambinia verticalis*, Dist., on sandal, and it was not, therefore, included in the experiments. From field studies it is concluded that this Tropiduchid does not normally breed on sandal but on *Canthium didymum*, and occurs in large numbers where the latter plant is found.

About 600,000 insects were collected from a total of 28 plots comprising healthy or diseased sandal in different host associations, with a view to obtaining statistically an indication of the insect or insects responsible for the spread of spike disease.

The incidence of Coccids in a heavily diseased area was found to be far less than in a healthier one, and observations indicate that infested

trees do not contract the disease. From the absence of Cicadid nymphs in the earth along the roots of sandal, it is concluded that the immature stages are not concerned in the transmission of spike disease. The fluid excreta produced by adults of the Cicadids, *Platypleura hampsoni*, Dist., *P. octoguttata*, F., and *Lemuriana apicalis*, Germ., while feeding on diseased plants, has been injected into seven trees which are under observation.

Observations on Jassids in the field showed that *Petalocephala uniformis* and *Ledra mutica*, F., oviposit in the shoots of sandal, *Acropona prasina*, Wlk., in the tissues at the axil of the leaf and shoot, and *M. variabilis* in these tissues and at the base of the axillary shoot and in green succulent shoots. The Flatid, *Melicharia lutescens*, Wlk., and *T. verticalis* oviposit in the bark of the shoots and the latter also in the tissues of succulent shoots and in the petiole and mid-rib of the leaves, and the Eurybrachid, *Eurybrachys tomentosa*, F., lays its eggs in clusters on the shoots, stems and leaves. The adults of the Cicadids, *Platypleura hampsoni*, *P. octoguttata*, *Cryptotympana intermedia*, Sign., and *L. apicalis*, feed on the shoots and stems of healthy and diseased sandal, the nymphs of *Petalocephala uniformis* on the leaves and the adults on the shoots, the young nymphs of *A. prasina* on the leaves and the later instars and the adults on the shoots, the nymphs of *M. lutescens* on the leaves and the adults on the shoots, the nymphs and adults of *Moonia variabilis* and *Ledra mutica* on the petioles of the leaves and on the shoots, the young nymphs of the Issid, *Tatva bufo*, Dist., on the leaves and the later stages on the shoots and petioles of the leaves, the young nymphs of *E. tomentosa* on the new growth and tender shoots and the later stages on the shoots. A sandal shoot or young seedling has been completely defoliated and has died back within two months as the result of the feeding of *P. uniformis* or *Sarima* sp. The progeny from two females of the Coccid, *Saissetia* (*Lecanium*) *nigra*, Nietn., caused sandal shoots to die back within five months. *P. uniformis*, *M. variabilis*, *A. prasina*, *L. mutica* and *E. tomentosa* have three generations annually, and except in the case of the last-named, the life of the adult occupies three months or more.

Zeck (E. H.) & Noble (N. S.). **Thrips. Experiments for the Control of *Thrips imaginis* Bagnall.**—*Agric. Gaz. N.S.W.*, xliii, pt. 3, pp. 231–236, 1 fig. Sydney, 1st March 1932.

Thrips imaginis, Bagn., is indigenous to Australia and occurs over a wide area and on an extensive range of food-plants. Its life-cycle is passed in the flowers, with the exception of the prepupal and pupal periods, which are spent in the ground. It occurs annually in New South Wales in limited numbers, but for a few months during certain years favourable climatic conditions may cause it to reach serious proportions. It was found infesting weeds during the late winter of 1931 ; the numbers increased throughout the State until October (when 8,630 individuals were found to be present in three rose blossoms in Sydney) after which they decreased, few thrips being found in December. In orchards stone fruits were first attacked, the crops of prune, plum and peach being considerably reduced, and later infestation resulted in serious injury to the blossoms of apple and pear. *Citrus* and vines were much infested, but the setting of fruit was not affected. The early vegetable crops were attacked, losses being experienced with tomatos and beans, and considerable damage was done to flowers in gardens.

Laboratory experiments with a total of 58 different sprays and dusts showed kerosene emulsion to be one of the most effective. Subsequent field tests showed that six applications of kerosene emulsion (1 : 33) every three days, and three applications of kerosene emulsion (1 : 11) at similar intervals, may be applied safely to the foliage of *Citrus*, peach and rose, and the foliage, flowers and fruit of grape. Tests also indicated that tomatos may safely be treated with two applications of the weaker spray under normal conditions, and that in cool weather further applications might be made without injury. One application of lime-sulphur combined with nicotine sulphate and emulsified oil caused scorching and defoliation of peaches, but did not injure *Citrus* or apple. A combination of nicotine sulphate and miscible white oil commonly recommended for the control of this thrips did not prove satisfactory in laboratory tests. As a result of these experiments, the use of kerosene emulsion (1 : 33) just before the flower buds open and at intervals throughout the blossoming period is recommended.

PAPERS NOTICED BY TITLE ONLY.

GILLETTE (C. P.) & PALMER (M.). **Six new Aphids from Colorado.**—*Ann. Ent. Soc. Amer.*, xxv, no. 1, pp. 136–148, 2 pls. Columbus, Ohio, March 1932.

DEAN (R. W.). **The Alimentary Canal of the Apple Maggot.** *Rhagoletis pomonella* **Walsh (Dipt. : Trypetidae).**—*Ann. Ent. Soc. Amer.*, xxv, no. 1, pp. 210–218, 4 pls., 12 refs. Columbus, Ohio, March 1932.

EDDY (C. O.) & NETTLES (W. C.). **Biological Studies of the Oriental Fruit Moth** [*Cydia molesta*, **Busck**] **1930.**—*Bull. S. Carolina Agric. Expt. Sta.*, no. 278, 21 pp., 6 figs., 4 refs. Clemson College, S.C., August 1931. [For Abstract see *R.A.E.*, A, xix, 673.]

KELSHEIMER (E. G.). **Leafhopper Response to colored Lights.**—*Ohio J. Sci.*, xxxii, no. 2, pp. 85–94, 1 pl. Columbus, Ohio, March 1932.

Directions for Spraying Fruits in Illinois.—*Circ. Illinois Agric. Expt. Sta.*, no. 388, 22+2 (suppl.) pp., 4 figs. Urbana, Ill., February 1932. [Revision of no. 277, *R.A.E.*, A, xii, 545.]

GILBERT (W. W.) & POPENOE (C. H.). **Diseases and Insects of Garden Vegetables.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 1371 (revd.), 46 pp., 65 figs., 1 ref. Washington, D.C., December 1931. [Recd. April 1932.] [*Cf. R.A.E.*, A, xii, 208.]

MCATEE (W. L.). **Usefulness of Birds on the Farm.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 1682, 14 pp., 7 figs., 6 refs. Washington, D.C., December 1931. [Recd. April 1932.]

BÖRNER (C.). **Mitteilungen über Blattläuse.** [Communications on Aphids.]—*Anz. Schädlingsk.*, viii, no. 4, pp. 38–40. Berlin, April 1932.

MALENOTTI (E.). **Die Speichelkegel der Pentatomiden.** [The Saliva Cones of Pentatomids (*Aelia acuminata*, L.).]—*Anz. Schädlingsk.*, viii, no. 4, pp. 40–44, 6 figs. Berlin, April 1932. [Translation of paper already noticed, *R.A.E.*, A, xx, 205.]

Staar (G.). **Ueber ein Kontaktthermometer und ein dazugehöriges (Universal-) Relais zur automatischen Temperaturregelung.** [A Contact Thermometer and Relay appertaining thereto for the automatic Regulation of Temperature.]—*Zbl. Bakt.*, (2) lxxxv, no. 21–26, pp. 425–430, 6 figs. Jena, April 1932.

Butenandt (A.) & McCartney (W.). **Untersuchungen über pflanzliche Fisch- und Insektengifte. III. 3. Mitteilung über Rotenon, den physiologisch wirksamen Bestandteil der** *Derris elliptica*: **Die Konstitution des Rotenons.** [Investigations on vegetable Fish and Insect Poisons. III. Third Communication on Rotenone, the physiologically active Constituent of *Derris elliptica*: The chemical Constitution of Rotenone.]—*Liebigs Ann. Chemie*, ccccxciv, no. 1, pp. 17–41. Berlin, 4th April 1932. [*Cf. R.A.E.*, A, xviii, 455.]

Balachowsky (A.). **Contribution à l'étude des Coccides de France. 8me note. Sur un** *Pseudococcus* **nouveau des îles d'Hyères.** *Pseudococcus lanatus*, **n. sp.**—*Bull. Soc. ent. Fr.*, xxxvii, no. 6, pp. 87–89, 1 fig. Paris, 1932.

Acqua (C.). **Le alterazioni provocate dalla poliedria nel** *Bombyx mori* **studiate secondo i nuovi metodi di colorazione.** [Changes due to Polyhedral Disease in *B. mori* studied by new Methods of Staining.]—*Boll. Staz. sper. Gelsic. Bachic. Ascoli Piceno*, xi, no. 1–2, pp. 3–10, 2 pls. Ascoli Piceno, 1932.

Peska (W.). **Some Observations on the Coloration of Pupae of the Apple Blossom Weevil,** *Anthonomus pomorum* **L.** [*In English.*]—*Prace Wydz. Chorób. Roślin państw. Inst. nauk. Gosp. wiejsk. Bydgoszczy*, no. 9, pp. 25–28, 4 refs. Bydgoszcz [Bromberg], 1930. (With a Summary in Polish.) [Recd. March 1932.]

Catalogue of Literature on injurious Insects in U.S.S.R. in 1925–1928. [*In Russian*: Agricultural and forest Pests 1661 titles: medical and veterinary entomology 856 titles.]—[*Pub.*] *Lenin Acad. Agric. Sci. U.S.S.R., Inst. Plant Prot.*, no. 20, 95 pp. Leningrad, 1931. Price 1 *rub.* 50 *kop.* [Recd. May 1932.]

Boczkowska (M.). **Zmiany w organizmie gąsienicy bielinka kapustnika (***Pieris brassicae* **L.) wskutek porażenia owadomorkiem korzonkowym (***Entomophthora sphaerosperma* **Fres.).** [Changes that occur in the Organism of the Larva of the Cabbage White Butterfly (*P. brassicae*) as a Result of Infection by *E. sphaerosperma*.] [*In Polish.*]—*Rocz. Nauk roln. leśn.*, xxvii, pp. 137–156, 1 pl., 8 figs., 32 refs. Posen, 1932. (With a Summary in English.)

Ferrière (C.). **Un nouveau Chalcidien gallicole de Sumatra** [*Protanaostigma derricola*, sp. n., from galls on *Derris elliptica*].—*Misc. zool. sumatr.*, lxiii, 4 pp., 1 fig., 2 refs. Medan, April 1932.

Chen (Kan-fan). **A preliminary List of the Mulberry Tree Insects of Chekiang Province.**—*Tech. Bull. Bur. Ent. Phytopath. Hangchow*, no. 3, 6 pp. Hangchow, China, 15th December 1931. [Recd. May 1932.]

Kuwana (I.) & Muramatsu (K.). **Three new Species of Diaspine Coccids from Japan.** [*In Japanese.*]—*J. Plant Prot.*, xix, no. 2, pp. 95–100, 1 pl. Tokyo, February 1932.

DUMBLETON (L. J.). **Report on Spruce-Aphis Investigation for the Year ending December 1930.**—*N. Z. J. Sci. Tech.*, xiii, no. 4, pp. 207–220, 12 figs., 22 refs. Wellington, N.Z., 1932. Also as *Bull. For. Biol. Res. Sta. Cawthron Inst.*, no. 1. Nelson, N.Z. [1932].

In consequence of the unhealthy condition of spruce throughout New Zealand, an investigation was begun in November 1929 as a preliminary to the control of the spruce aphis, *Neomyzaphis abietina*, Wlk., which was first recorded there in 1922, when it was reported to have been killing the trees in a wholesale manner in one district. Descriptions are given of the apterous, alate and intermediate viviparous females, which last were taken on spruce from July onward and reproduced freely, giving rise to apterous forms only. Sexuales have never been observed in this species. Its food-plants are recorded from the literature ; it has not been found in the field in New Zealand on genera other than *Picea*. *P. excelsa* and *P. sitchensis* are both severely defoliated, the latter being the more susceptible to injury ; *P. morinda* is also attacked but is more resistant. The method of feeding of Aphids and the effect of their saliva on the plant tissues are briefly discussed [*cf. R.A.E.*, A, xi, 250 ; xviii, 162, etc.]. The feeding of *N. abietina* produces a yellow spot on the needle, and later the affected area turns brown. When there are several feeding spots the needle eventually dies and falls from the twig. The needles produced in spring are not injured by the Aphids until the following autumn and winter. Apterous adults reproduce throughout the year, but their numbers and rate of reproduction vary with the season. Larvae produced by alate females on *P. sitchensis* developed into apterous adults. In experimental transfers to potted plants, larvae produced by alate Aphids on *Pinus sylvestris* and *P. strobus* matured normally and produced larvae, but the colonies tended to die out about November. No alates were produced on the pine. Larvae produced by apterous Aphids on *P. sylvestris* did not mature, but in one case on *P. strobus* the larvae developed and founded a colony. Neither alates nor apterae reproduced successfully on *Pseudotsuga taxifolia*. Apparently any migration to pine that may occur is not obligatory, and the life-cycle is normally completed on spruce.

The natural enemies of *N. abietina* are recorded from the literature ; those observed in New Zealand include *Melanostoma fasciatum*, Macq., and the Hemerobiid, *Micromus tasmaniae*, Wlk. Another Hemerobiid, *Drepanacra biocula*, Newm., and *Syrphus novae-zealandiae*, Macq., were reared from larvae attacking the Aphid during the present investigation. *Hippodamia convergens*, Guér., was introduced into New Zealand in 1921 against this and other Aphids, but has not been recovered on spruce. As spraying and dusting would probably be too expensive for large areas of high forest, efforts are being made to obtain specific parasites and general Aphid predators from Europe and America.

Paratetranychus ununguis, Jac. (conifer spinning-mite) is frequently present with *N. abietina* in New Zealand and is thought to be relatively more injurious. Where isolated trees or single lines of spruce occur, the effects of exposure result in severe defoliation by both mites and Aphids. Brief notes on the bionomics of the mite are given from the literature. It occurs on spruce throughout South Island and is found in North Island, where its distribution is not known. In the early

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stages of infestation, the damaged needles show a fine white mottling over the entire surface ; they later turn brown, being only held in place by the web spun by the mites. By the end of March the mites have mostly disappeared. The winter is passed in the egg stage on the twigs. From October onward the mites are present on the trees in small numbers, but increase very rapidly in hot, dry weather. They attack the current year's growth, and are thus more injurious than the Aphid. Sprays are practicable only in the case of ornamental and nursery stock ; those advised in the literature include a solution of soft soap in 5–10 parts water, or, in early spring, miscible oil 1 : 15. Later in the season drenching the tree with a strong stream of water will dislodge and destroy many of the mites. The larva of *Tortrix excessana*, Wlk., does minor damage by defoliating the twigs.

Clark (A. F.). **Insects infesting *Pinus radiata* in New Zealand.**—*N. Z. J. Sci. Tech.*, xiii, no. 4, pp. 235–243, 4 figs., 8 refs. Wellington, N.Z., 1932.

Sirex noctilio, F., which occurs throughout New Zealand on *Pinus radiata* and other exotic conifers, was originally recorded as *S. juvencus*, L. The characters distinguishing these species are given. The attack is most severe on badly suppressed trees and those damaged by fire, breakage, *Chermes pini*, L., or, possibly, a fungus. The parasite, *Rhyssa persuasoria*, L., which has already been introduced and liberated against this pest, is not sufficient to control it without careful management and prompt forestry measures. A severe attack of *C. pini* on trees grown under unfavourable conditions results in marked diminution in growth, malformation of stem and branches, defoliation and sometimes death. Predators attacking this Aphid, which do not, however, reduce its numbers to any great extent, are *Micromus tasmaniae*, Wlk., *Protobiella zelandica*, Till., and *Syrphus novaezealandiae*, Macq. *Hylastes ater*, Payk., breeds in the roots, stumps and logs and kills newly planted trees by eating the bark tissues about the ground level. *Ernobius mollis*, L., occurs in the bark of dead standing trees, particularly in burned timber ; in New Zealand it is a secondary pest only. One case of attack by *Desiantha maculata*, Blackb., on seedling pines is recorded. *Heliothrips haemorrhoidalis*, Bch., occasionally infests the young needles of *P. radiata* in the warmer districts of North Island. Another thrips, provisionally identified as *Haplothrips corticis*, DeG., feeds on decaying material beneath the bark of dead trees in moist situations. All the above are introduced species.

Indigenous insects that attack *P. radiata* include the weevils, *Psepholax coronatus*, White, which attacks dead standing and fallen trees in North Island, and *Torostoma apicale*, Broun, *Phloeophagosoma* sp., *Inosomus rufopiceus*, Broun, and *Euophryum porcatum*, Sharp, which occur under the bark of dead or dying trees or in stumps or logs and are sometimes quite plentiful in North Island ; the bark-beetle, *Pachycotes ventralis*, Sharp, infesting fallen timber ; *Platypus douei*, Reiche, which attacks dead and dying trees, fresh stumps and burned timber, especially in the North Island ; the Colydiids, *Pycnomerus sophorae*, Sharp, and *Ulonotus antarcticus*, White, the former of which is found under the bark of stumps in both Islands, the latter being less common ; the Prionid, *Prionoplus recticularis*, White, which commonly infests dead trees, logs and stumps, the eggs being deposited in batches beneath the bark and the larvae constructing galleries in the

wood ; the Cerambycid, *Navomorpha sulcata*, F., occurring mainly in North Island, with a wide range of food-plants, including apple ; the Lamiid, *Hexatricha pulverulenta*, Westw., found in dead standing and fallen timber, chiefly in South Island ; and the Psychid, *Oeceticus omnivorus*, Fereday, the larvae of which feed upon the needles and from which the parasites, *Phorocera feredayi*, Hutt., *P. marginata*, Hutt., *P. nefaria*, Hutt., and *Echthromorpha intricatoria*, F., have been recorded. The Tortricids, *Tortrix excessana*, Wlk., and *Ctenopseustis obliquana*, Wlk., cause considerable damage at times to young stands in both Islands. Larger trees are also sometimes attacked, sporadic outbreaks occurring when local climatic conditions are favourable to the moths. *Trichogramma minutum*, Riley, has been reared from the egg-masses, and other undetermined parasites occur. Tortricid larvae have also been found in the stems of young shoots, and it is thought that they may represent a third species. *Calotermes brouni*, Frogg., infests dead or partly dead timber, over-mature trees being particularly liable to attack. The Eumolpid, *Eucolaspis brunnea*, F., which is a well-known orchard pest, occasionally feeds in the adult stage on the needles of young pines, sometimes causing severe defoliation. The larvae of *Odontria* spp. (grass grubs) sometimes attack the roots of seedlings, and those of the cockchafer, *Chlorochiton* (*Stethaspis*) *suturalis*, F., the roots of newly planted trees.

Yago (M.). **Studies on the Pear Leaf-roller,** *Cacoecia xylosteana* **L. (Preliminary Report).** [*In Japanese.*]—*Bull. Shizuoka Agric. Expt. Sta.*, no. 22, pp. 1–14, 1 pl., Shizuoka, November 1931.

The larvae of *Tortrix* (*Cacoecia*) *xylosteana*, L., which hatch at the end of March and in April, feed on the leaves, buds and flowers of pear in Japan and also on any fruit near the leaves. Apple, cherry, plum, *Citrus*, *Salix* and rhododendron are also attacked. There is one generation a year, the winter being passed in the egg stage. The larval stage averages 40·3 days in the case of females and 34 days in that of males, and the pupal stage lasts 7–19 and 9–20 days respectively. The moths emerge from the end of May to the beginning of July, and 200–300 eggs may be laid by a single individual. The eggs may be destroyed by oil emulsions, or a resin wash, and the larvae by lead arsenate.

Matsuda (M.). **Studies on** *Chrysomphalus aonidum* **L. (5).** [*In Japanese.*]—*Agric. & Hort.*, vii, no. 3, pp. 449–459, 3 figs. Tokyo, March 1932.

In Japan, both sexes of *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.) are found on both sides of the leaves of *Quercus glauca*, but only on the upper surface of those of *Pasania edulis*. On *Citrus* the males are usually found on the upper surface and the females on the lower.

Iwasa (T.). **The Relation of the Time of Emergence of** *Chilo simplex* **Butl. to Light.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 1, pp. 21–23. Tokyo, 1932.

Observations in Japan show that the adults of *Chilo simplex*, Butl., chiefly emerge between 6 and 8 p.m., which is also the time at which they are most active.

KINOSHITA (S.) & YAGI (S.). **On the northern Limit of Distribution of *Schoenobius incertellus* Wlk.** [*In Japanese.*]—*J. Plant Prot.*, xix, no. 3, pp. 173–175. Tokyo, March 1932.

In Japan, *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.), which only attacks rice, is confined to areas where the winter temperature is always above —3·5°C. [25·7°F.].

MURATA (T.) & HIRANO (I.). **Relation of Outbreaks of Leafhoppers to climatic Conditions, 1–3.** [*In Japanese.*]—*J. Plant Prot.*, xix, nos. 1–3, pp. 20–24, 103–108, 183–190. Tokyo, January–March 1932.

Outbreaks of *Sogata* (*Delphacodes*) *furcifera*, Horv., and *Delphacodes oryzae*, Mats., on rice in Japan since 1868 are recorded, and various theories regarding the causes of such outbreaks are reviewed. Outbreaks of *D. furcifera* have coincided with years of slight rainfall in June, and those of *D. oryzae* have occurred when there has been little rainfall in July.

ESAKI (T.) & HASHIMOTO (S.). **Report on the Leafhoppers injurious to the Rice Plant and their natural Enemies, No. 3 (for the Year 1931).** [*In Japanese.*]—*Publ. Ent. Lab. Dept. Agric. Kyushu Imp. Univ.*, no. 3, pp. 1–42, 10 figs. Fukuoka, March 1932.

The results of the life-history studies during 1931 on *Nephotettix bipunctatus cincticeps*, Uhl., *Deltocephalus dorsalis*, Motsch., *Delphacodes striatella*, Fall., and *Sogata* (*Liburnia*) *furcifera*, Horv., infesting rice in Japan are similar to those obtained in previous years [*R.A.E.*, A, xviii, 555 ; xix, 339]. The brachypterous females of *D. striatella* live 36–40 days and the macropterous ones 31–38. *Nilaparvata* (*Liburnia*) *oryzae*, Mats., which was numerous near Fukuoka, had 5 generations, development requiring 13–22 days. The brachypterous forms are common in both sexes, especially in September and October. The females, which produce on an average 159 eggs in the second generation and 170 in the third, live up to 33 days and the males up to 28. The Dryinid, *Haplogonatopus atratus*, sp. n., and a Mymarid, *Anagrus* sp., are parasitic on *D. striatella* ; the Stylopid, *Elenchinus japonicus*, Esaki & Hshm. [xix, 339] on *N. oryzae* and *D. striatella* ; *Tettigoxenos orientalis*, Esaki & Hshm. [*loc. cit.*] on *N. bipunctatus cincticeps*, the adults emerging in July and September ; and species of *Pipunculus* on *Nilaparvata* and *Anconura producta*, Mats. *Pseudogonatopus flavifemur*, sp. n., and *Agonatopus gracilis*, sp. n., are described, but the hosts are unknown.

SIMMONDS (H. W.). **Biological Control of *Clidemia hirta*. (Introduction of *Liothrips urichi*, Karny, into Fiji.)**—*Legis. Council Paper, Fiji*, 1932, no. 4, 3 pp. Suva, 1932.

Details are given of the spread in Fiji of *Liothrips urichi*, Karny, which was introduced from Trinidad in 1930 for the control of the weed, *Clidemia hirta* [*R.A.E.*, A, xvi, 616]. Owing probably to the exceptionally dry weather towards the end of 1930, the thrips had made very little progress up to February 1931. During the remainder of the year, however, it spread rapidly, in some instances migrating over a mile

of sea or two of jungle. It covered distances of six or seven miles down wind and also made some progress in the opposite direction. It can be assisted by cutting down heavy growth of *Clidemia*, as the new shoots that then appear favour its rapid increase.

THUNG (T. H.). **De krul- en kroepoek-ziekten van tabak en de oorzaken van hare verbreiding.** [The Curl and Crinkle Diseases of Tobacco and the Causes of their Dissemination.]—*Meded. Proefst. vorstenl. Tabak*, no. 72, 54 pp., 3 figs., 16 pls., 17 refs. Klaten (Java), 1932. (With a Summary in English.)

Leaf-curl and two forms of leaf-crinkle, all of which are virus diseases, occur on tobacco in the Vorstenland districts of Java. Diseased plants, which chiefly occur in sheltered situations, lag in growth, and the tobacco is inferior in quantity and quality. In common crinkle the leaf-edge is in places curled towards the dorsal surface, which shows thickenings and outgrowths of the veins ; in transparent crinkle the leaf curls towards the ventral surface, and the veins become transparent ; and in leaf-curl the whole leaf-edge is curled towards the dorsal surface, the veins showing outgrowths and the lamina between the finer veins becoming bulbous. Transmission was accomplished in each case by grafting, but not by sap or through the seed. In experiments with insects negative results were obtained with Capsids, thrips and *Myzus persicae*, Sulz., but the adults of an Aleurodid transmitted the three types of disease unchanged. This white-fly was identified as a species of *Bemisia*, apparently distinct from the species found by Storey to transmit a similar disease of tobacco at Amani (Tanganyika) and in Rhodesia [*R.A.E.*, A, xx, 330]. This Aleurodid oviposits on the leaves, and the eggs hatch in about 8 days. As crinkle occurred on experimental tobacco plants grown in pots before tobacco was in the field, an investigation was made of plants other than tobacco from which infected Aleurodids must have migrated. A list is given of 34 plants belonging to 17 different families on which were found Aleurodids apparently similar but probably not identical with the experimental vectors. Individuals found on *Synedrella nodiflora*, *Phyllanthus niruri*, *Nicotiana glauca* and *N. rustica* survived when transferred to tobacco.

DE AZEVEDO MARQUES (L. A.). **Insectos damninhos á batata dôce, seus habitos e os meios de combatel-os.** [Insect Pests of the Sweet Potato, their Habits and Methods of combating them.]—*O Campo*, iii, no. 1, pp. 44–48, no. 2, pp. 33–37, 9 figs. Rio de Janeiro, January-February 1932.

A list is given of the insects recorded up to 1930 as infesting sweet potato in Brazil, with notes on the bionomics of the weevil, *Euscepes batatae*, Waterh., and the Cassidids, *Neomphalia sexpustulata*, F., *Chelymorpha cribraria*, F., *C. puncticollis*, Boh., *C. rufipennis*, Boh., *C. constellata*, Klug, and *Metriona judaica*, F. The distribution and duration of development in Brazil of these Cassidids are recorded, and the adults are described. They all have similar habits, both adults and larvae feeding on the foliage of the sweet potato, but the injury done by the former is comparatively small. The adults die if starved for 15 days, but can live about 6 months if food is available. The measures advocated are hand collection of all stages and the use of a

spray of 7 oz. Paris green, 20 oz. quicklime, 16 oz. wheat flour or honey, and 125 gals. water. *Euscepes batatae*, all stages of which are described, occurs throughout Brazil. The adults mate and oviposit repeatedly, depositing about 26 eggs at a time. The egg, larval and pupal stages last 8–10, 15–20 and 10–12 days, the larvae feeding and pupating inside the tubers. Measures can be directed only against the adults. They consist in keeping store-rooms free from infestation ; careful selection of tubers for planting ; burning of infested tubers ; and crop rotation. Before a field is replanted with sweet potato, pieces of tubers should be scattered over the whole surface. These will attract the weevils if they are present and thus indicate if there is any danger of infestation.

KNIGHT (Hugh). **Some Notes on Scale Resistance and Population Density.**—*J. Ent. Zool.*, xxiv, no. 1, p. 1. Claremont, Cal., March 1932.

Owing to the continuous application of control measures, certain Coccids attacking *Citrus* in California have developed high powers of resistance. The difficulty experienced in eradicating heavy infestations has generally been attributed merely to the fact that with similar percentages of control a greater number of Coccids are unaffected in the groves with heavier infestations. However, as a result of investigations during 1931 in lemon groves that had been sprayed with various oil emulsions for the control of *Chrysomphalus aurantii*, Mask. (red scale), it appears that the density of the population influences the actual percentage of mortality. The resistance to control varies directly, and the percentage of control inversely, with the density of population ; thus, on lemons with infestations of 1–100 and 200–300 Coccids, 95·97 and 72·90 per cent. mortality was obtained respectively. The same tendency was observed in counts from fumigated plots in the same area.

FRICKHINGER (H. W.). **Einige weniger bekannte Grünlandschädlinge. Eine Literaturzusammenstellung.** [Some little known Pests of Meadow Lands. A Compilation from the Literature.]—*Prakt. Bl. Pflanzenb.*, x, no. 1–2, pp. 33–37. Freising, 1932.

The Noctuid, *Parastichtis* (*Hadena*) *monoglypha*, Hfn., did considerable damage in meadows in Germany in 1931. The eggs are laid on grass in mid-summer, and the larvae, which hatch in autumn and hibernate, attack the grass above the roots, the principal injury, which is often ascribed to Tipulids, being done from May onwards. Burning the dead grass or strewing calcium cyanamide after rain is said to give good results. Loss of red clover seed is caused by the larvae of *Apion apricans*, Hbst., which feed in the blossoms. A spray of nicotine and soap is suggested. The larvae of *A. virens*, Hbst., mine in clover plants, hibernating in the roots. Pupation occurs in June. This weevil has caused losses of 80–90 per cent. in Austria. The growing of clovers native to the district in admixture with grass is recommended. White ear in sheep fescue grass [*Festuca ovina*], due mainly to *Pediculopsis* (*Pediculoides*) *graminum*, Reut., has occurred in North Germany. Abundant manuring reduces the loss, but in cases of very severe infestation the field should be ploughed and planted for 3 years with leguminous or root crops.

Ameisenbekämpfung in Lebensmittelbetrieben. [The Control of Ants in Foodstuff Businesses.]—*Mitt. Ges. Vorratsschutz*, viii, no. 3, pp. 30–31. Berlin, 1932.

Increased complaints of the infestation of food stores by ants were made in the spring of 1932 in Germany. *Monomorium pharaonis*, L., an imported and comparatively rare species, is occasionally concerned, but the ants usually found are *Lasius niger*, L., *L. brunneus*, Latr., *L. fuliginosus*, Latr., *L. emarginatus*, Ol., and *L. umbratus*, Nyl. For control, their nests should be traced and either flooded with water or fumigated with carbon bisulphide, etc. If this is impracticable, a commercial poison-bait may be used or one consisting of 120 parts by weight of thick syrup and any of the following : 1 part lead arsenate, $\frac{1}{2}$ part tartar emetic, 3 parts chloral hydrate, or $\frac{1}{8}$–$\frac{1}{4}$ part arsenic trioxide. A perforated tin containing a sponge soaked in the liquid should be buried near the nest. A non-poisonous bait can be prepared with 1 part synthetic honey and 1 part of 10 per cent. potassium carbonate.

Bua (G.). **Risultati di nuovi esperimenti di attrazione della Mosca delle olive eseguiti nel comune di Pisciotta (Salerno) nel 1931.** [Results of new Experiments with Attractants for the Olive Fly carried out in the Commune of Pisciotta (Salerno) in 1931.]—*Ann. R. Inst. sup. agrar.*, (3) v (1931), pp. 63–71. Portici, 1932.

Continuing previous experiments with poison baits for the olive fly, *Dacus oleae*, Gmel. [*R.A.E.*, A, xix, 516, etc.], new formulae were tried, the results being compared with those already obtained. The best results were given by a commercial preparation (Dachicida F. 1931) that contained 2·2 parts by weight of water, 1·8 of ammonium fluoride, and 96 of the normal stock bait-solution (95 gals. beet molasses, 25 lb. sodium arsenite, and $2\frac{1}{2}$–3 gals. water). This is a modification of the preparation (Dachicida F.) found to be the best in 1930 and was also used at 10 per cent. strength. It now appears that the presence of the ammonium fluoride is the reason for the greater attractiveness of the bait and that the quality of the molasses is not involved [*cf. loc. cit.*].

Vecchi (A.). **Le api e le irrorazioni arsenicali ai frutteti.** [Bees and Orchard Spraying with Arsenicals.]—*L'Italia agric.*, lxviii, no. 11, reprint 7 pp. Piacenza, November 1931. [Recd. May 1932.]

In experiments in Italy the addition of a proprietary repellent to lead arsenate sprays prevented bees from being poisoned by them. Crude carbolic acid proved ineffective as a repellent, and though Bordeaux mixture reduced the number of bees killed, it was not reliable. The lead arsenate sprays are chiefly used in orchards against *Hoplocampa fulvicornis*, Panz. (*minuta*, Christ), *H. flava*, L., *Cydia pomonella*, L., and *Anthonomus pomorum*, L., and the safety of the bees can be ensured by delaying their application until the petals have fallen.

Borg (J.). **Scale insects of the Maltese Islands.**—Demy 8vo, 20 pp. Malta, Govt. Ptg. Off., 1932.

The economic importance of Coccids and the danger of their introduction and establishment in previously uninfested countries are discussed. A list is given of the 59 species present in the Maltese Islands with their food-plants, as well as notes on their natural enemies.

Deshusses (J.) & Deshusses (L.). **Quelques insectes spéciaux, nuisibles aux cultures de la Suisse romande. 2me note.**—*C. R. Soc. Phys. Hist. nat. Genève*, xlviii, no. 3, pp. 164–166. Geneva, 1931.

Further insect pests are recorded from Switzerland [*cf. R.A.E.*, A, xix, 586]. The Curculionid, *Ceuthorrhynchus terminatus*, Hbst., is frequently found on *Sium angustifolium*, and in the last two years has damaged celery (*Apium graveolens*), the larvae mining in the leaves. The pupal stage is passed in the ground and lasts 10–15 days, and from 27th June the adults are found on the leaves, perforating the epidermis. The larvae of the Cephid, *Janus compressus*, F., mine the young branches of pear and apple; and although they may cause considerable damage, this has not hitherto been recognised.

Other pests include *Cassida viridis*, L., on *Stachys affinis* (Chinese artichoke), and the Lycaenid, *Lampides* (*Polyommatus*) *baetica*, L., on peas and beans.

Werth (E.) & others. **Krankheiten und Beschädigungen der Kulturpflanzen im Jahre 1929.** [Diseases and Injuries of Cultivated Plants in 1929 in Germany.]—*Mitt. biol. Reichsanst. Land- u. Forstw.*, no. 43, 57 pp., 3 graphs, 30 maps. Berlin, April 1932.

This report contains annotated lists of the insect pests recorded in Germany in 1929, divided according to the class of crop attacked.

Thiem (H.). **Ein auswechselbares biologisches Bodensieb.** [An interchangeable biological Soil Sieve.]—*NachrBl. deuts. PflSch-Dienst*, xii, no. 5, pp. 33–34, 2 figs. Berlin, May 1932.

This apparatus, which has been successfully used in Germany for separating pupae of *Rhagoletis cerasi*, L., from soil, is somewhat similar to those described by Morris [*R.A.E.*, A, x, 527] and Shirck [xix, 213] and consists of a tripod that supports a funnel over which are placed 4 close-fitting sieves one above the other. Each sieve has an interchangeable bottom, consisting of a screen disk soldered to a metal ring.

Reckendorfer (P.). **Eine neue Methode zur Bestimmung der Haftfähigkeit (Windfestigkeit) von Stäubemitteln.** [A new Method for ascertaining Adhesiveness (Resistance to Wind) of Dust Insecticides and Fungicides.]—*Fortschr. Landw.*, vii, no. 8, pp. 222 *et seq.* (reprint 12 pp.), 7 figs., 3 refs. Vienna, 15th April 1932.

The adhesiveness of dust insecticides is determined by the carrier. In the Görnitz method of testing adhesiveness, a series of taps are given to an inclined plate on which the material to be tested has been sifted [*R.A.E.*, A, xv, 646]. The type of movement caused by wind is not, however, reproduced, and this paper describes preliminary experiments with a method more comparable with conditions in nature. Disks punched from leaves that are not wet with rain or dew are laid on a plate over which is placed a cardboard cylinder. The dust to be tested is blown into the open end of the cylinder, which is then covered with a sheet of cardboard. When the dust has settled, one of the disks is laid in a holder, which is then fixed to a stem placed in a wind-tunnel fitted with a fan producing air currents of known velocities. The

tunnel has gratings ensuring a uniform flow of air. The dust from the disk is compared with that from one of the other disks by chemical analysis. The dusts tested by the author were mixtures of 30 per cent. arsenic trioxide with 70 per cent. French chalk, kaolin, calcium carbonate, kieselguhr and magnesium carbonate, respectively. Exposure for 12 minutes to an air current of 8·5 miles per hour caused a loss of 22 per cent. of the dust with French chalk and kaolin, 30 with calcium carbonate, 33 with kieselguhr, and 80–90 with magnesium carbonate. The results at 9·4 miles per hour were slightly different but confirmed the above sequence. According to Görnitz [*loc. cit.*], calcium carbonate has only about one-third the adhesiveness of French chalk, whereas here it was very much less inferior.

Warburton (C.). **Annual Report for 1931 of the Zoologist.**—*J. R. Agric. Soc. England*, xcii, pp. 442–448. London, 1931. [Recd. May 1932.]

A brief review is given of insect and other pests observed in England during 1931, the former being for the most part of normal occurrence, with additional notes on points considered of special interest. With reference to infestation of winter wheat by frit fly [*Oscinella frit*, L.], it is pointed out that winter crops are planted too late to be attacked directly. In the case of wheat it appears that the larvae migrate from the stubble of rye grass [*Lolium perenne*] to the germinating plants. Infestation of winter oats may have originated in a certain amount of self-sown wheat present in the field. The pygmy beetle [*Atomaria linearis*, Steph.] attacked germinating sugar-beet, but it has been reported that seeds soaked for 20 minutes in a mixture of 1 per cent. carbolic acid and 5 per cent. magnesium sulphate escaped damage.

Orr (M. Y.). **An Aphid** (*Neochmosis vanduzei* **Swain**) **new to the Forth Area.**—*Scot. Nat.*, no. 194, p. 53. Edinburgh, 1932.

The Aphid, *Neochmosis vanduzei*, Swain, was observed in 1931, in the Lothians, attacking young trees of Sitka spruce [*Picea sitchensis*].

Koubek (K.). **Studie o mouše burákové, škůdci řepy cukrové.** [Study of the Beet Fly, a Pest of Sugar Beet.] [*In Czech.*]—8vo, 88 pp., 42 figs., 3 tables, 7 graphs, 43 refs. Prague, Masarykova Akad. Práce [Works of the Masaryk Acad.], 1932. (With a Summary in French.)

This monograph is based on laboratory and field observations in beet-growing areas in Czechoslovakia and on data from the literature. The systematic position and varieties of *Pegomyia hyoscyami*, Panz., are discussed ; the author considers that the form that constantly breeds on beet may be distinguished as var. *betae*, Curt. Within this variety numerous variations occur in both sexes, the differences in which are shown in tables. Its bionomics are dealt with in detail, and all stages are described. One chapter is devoted to insect parasites and another to diseases. The egg parasite, *Trichogramma evanescens*, Westw., which was observed for the first time in Czechoslovakia in 1925, is believed to be of little value [*cf. R.A.E.*, A, xx, 259] ; observations in 1926 and 1927 showed that the percentage of eggs parasitised by it did not on an average exceed 0·5. Parasites of the larvae are briefly reviewed from

the literature ; their value is also thought to have been overrated, as of over 3,000 pupae of *Pegomyia* obtained from larvae collected in the field, only 8·2 per cent. gave rise to parasites. In addition to parasites that have already been recorded from *P. hyoscyami* var. *betae*, the author reared several unidentified species and a single individual of *Eucoila* (*Psichacra*) *anomala*, Kieff. Three examples of the latter emerged from larvae of *Pegomyia nigritarsis*, Zett., taken on *Rumex lapathifolia*.

Diseases appear to be far more important in controlling the fly, and a detailed account is given of preliminary research on them. Bacteria isolated from the body fluid of diseased larvae taken on beet proved to be pathogenic to healthy larvae of *Pegomyia* and to Tenebrionids by subcutaneous injection. The most serious infection of the larvae, which killed them in numbers in the autumn, was caused by minute protozoa. The bodies of the dead larvae also harboured organisms resembling torulae, which did not produce infection when injected into healthy larvae, though positive results were obtained when adult flies fed on contaminated material. Pupae were killed by a disease that reduced their contents to a yellow powder, but the causal agent was not found.

Control measures are briefly reviewed and include rolling, thinning the plants, and hoeing to destroy the pupae. Deep ploughing to bury the pupae is considered useless, as observations have shown that the adults can emerge from a depth of 15 ins. Attempts to destroy the flies by baits of chopped straw sprayed with a mixture of sweetened beer dregs or molasses and arsenic or by trapping them on paper coated with an adhesive were unsuccessful. Good results were obtained by dragging over the field a sheet of black canvas mounted on a rectangular frame so that the edges overlapped and having at the top a cage of light-coloured muslin in which the flies congregate.

Strawiński (K.). **Schädlinge, die auf dem Territorium der Lodzer Wojewodschaft vom Juni bis December 1930 beobachtet wurden.** [Pests observed in the Territory of the Lodz Region from June to December 1930.] [*In Polish.*]—*Choroby Roślin*, i, no. 3–4, reprint 14 pp., 1 map. Warsaw, 1931. (With Summary in German.) [Recd. April 1932.]

Notes are given on the local and seasonal distribution and food-plants of a number of pests, including 80 insects and 4 mites, recorded from various parts of the Lodz region from 1st June till 1st December 1930 as attacking cultivated crops, fruit and forest trees and stored products.

Wilkinson (D. S.). **Four new** *Apanteles* **(Hym., Brac.).**—*Stylops*, i, pt. 6, pp. 139–144, 2 figs. London, 15th June 1932.

Among the new species described are *Apanteles vernaliter* bred from larvae of a coconut-flower Tineid (yellow species) in Java, *A. schoenobii* from a larva of *Schoenobius* in South India, and *A. galleriae* from larvae of *Galleria mellonella*, L., in Montpellier, France. In 1912 Conte recorded *A. lateralis*, Hal., as a parasite of this moth [*cf. R.A.E.*, A, i, 454], but from his description of the adult it is clear that it is neither this species nor the new species described above. In 1926 Suire

[xvi, 240] recorded *A. hoplites*, Ratz., which differs from both the new species and Conte's parasite, and the same year Picard [xvi, 241] published notes on these two records expressing a doubt whether there were in reality two species of *Apanteles* parasitising the larvae of *G. mellonella*.

A. talidicida, Wlkn., originally described [xix, 377] from *Talides sergestus*, Cram., on *Heliconia* (wild plantain) in British Guiana, is now recorded from caterpillars of another Hesperiid, *Calpodes ethlius*, Cram., on *Canna* in Trinidad.

SITOWSKI (L.). **Strzygonia choinówka** (*Panolis flammea* **Schiff.**) **i jej pasorzyty na ziemiach polskich. Część III.** [The Pine Moth (*P. flammea*) and its Parasites in Poland. Part III.]—*Roczniki Nauk roln. i leśn.*, xxvii, reprint 12 pp., 13 refs. Poznań [Posen], 1932. (With a Summary in German.)

In continuation of previous work [*R.A.E.*, A, xi, 454; xiii, 7], numerous parasites were reared from larvae and pupae of *Panolis flammea*, Schiff., collected in various districts of Polish Silesia in 1929–1931. The Tachinids obtained were *Pales pavida*, Mg., which was the most important parasite, destroying 40 per cent. of the pupae in one locality, *Sturmia inconspicua*, Mg., which only occurred sporadically, *Phryxe vulgaris*, Fall., which seldom attacks the moth, *Lydella nigripes*, Fall., *Ernestia rudis*, Fall., *Echinomyia magnicornis*, Zett., and *Lydina aenea*, Mg. The last-named is a viviparous parasite that has not previously been recorded from *P. flammea*; it occurred in mixed stands of pine and oak, attacking *Panolis* on the former and *Acrobasis zelleri*, Rag., on the latter.

Muscina pabulorum, Fall., and *M. stabulans*, Fall., which infest only diseased larvae, were reared in a few instances, and larvae of the Phorid, *Megaselia* (*Aphiochaeta*) *rufipes*, Mg., were found in dead larvae and pupae. *Megaselia* occurred together with its Braconid parasite, *Orthostigma pumilum*, Nees, which is, however, probably also a primary parasite of *Panolis*, as it appeared in numbers in the second half of September in some localities where the latter was present, and has also been reared by the author from *Dendrolimus pini*, L.

A considerable percentage of the larvae of *P. flammea* were parasitised by Ichneumonids, of which the most numerous were *Banchus femoralis*, Thoms., *Ichneumon bilunulatus*, Grav., and *I. pachymerus*, Htg., others including *I. fabricator* var. *varicolor*, Ulbricht, *I. versator*, Thunb. (which had previously been obtained from pupae of *Bupalus piniarius*, L.), *I. latrator*, F., *I. comitator* var. *biannulatus*, Grav., *Amblyteles melanocastanus*, Grav., which is new to Poland, and *Anomalon cerinops*, Grav. The last-named and *I. latrator* have not previously been obtained from *P. flammea*. A parasite erroneously recorded as *I. lineator*, F. [xi, 454] has now been found to be *I. comitator*, L.

The Braconid, *Meteorus albiditarsis*, Curt., was also reared in several cases, and was itself parasitised by *Plectocryptus arrogans*, Grav., *Astiphromma variipes*, Holmgr., and *Pezomachus tonsus*, Frst., of which the last two were not previously known as hyperparasites. Other hyperparasites recorded are the Ichneumonids, *Cryptus dianae*, Grav., which in 1924 was thought to be a primary parasite of *P. flammea*

[xiii, 7], but has now been reared from *Banchus femoralis*; and *Mesochorus petiolaris*, Brischke, which was found in a pupa of *Winthemia amoena*, Mg., in 1924 [xiii, 7].

[Korotkikh (G.).] **Коротких (Г.). The Organisation of Work connected with the Application of Aeroplanes for the Control of Pests.** [*In Russian.*]—*Aviatz. Bor'be Vredit. sel'sk. i lesn. Khoz.* [*Aviation in Control of Agric. & Forest Pests.*] *Mater. 1st All-Union Avio-Chem. Conf. Moscow 1930*, pp. 41–51, 1 fig., 3 graphs. Moscow, Sel'kolkhozgiz [Agric. Co-op. Pub.], 1932.

Information is given on technical points connected with aeroplane dusting against insect pests, such as the planning of the work prior to the dusting, preliminary examination of the area to be treated, determination of the efficient dosage of the insecticide, methods of dusting and marking the limits of the area for the aeroplane, which was chiefly done by flags or smoke, and factors on which the working efficiency of the aeroplane depends. A table is given showing at what rates per hectare the different insecticides should be used against various types of pests, with notes on the damage caused by the dusts to the plants, and in some cases on carriers or other insecticides with which the principal poison should be mixed. Another table shows the width of the effective strips of dust, which vary according to the type of the pest to be controlled.

[Avvakumov (N.).] **Авваkумов (Н.). The Control of the Meadow Moth in Tz. Ch. O.** [*In Russian.*]—*Aviatz. Bor'be Vredit. sel'sk. i lesn. Khoz.* [*Aviation in Control of Agric. & Forest Pests.*] *Mater. 1st All-Union Avio-Chem. Conf. Moscow 1930*, pp. 110–120, 1 fig., 2 graphs. Moscow, Sel'kolkhozgiz [Agric. Co-op. Pub.], 1932.

The unusually severe outbreak of the meadow moth [*Loxostege sticticalis*, L.] in the Russian Union in 1929 [*R.A.E.*, A, xix, 279, 368, 521–526] was particularly injurious to sugar-beet. In the Black Soil Zone, the flight of the adults in 1930 was very protracted, and the larvae of the first generation did not appear before the beginning of July. Aeroplane dusting with calcium arsenite, either pure or mixed with equal parts of lime, was carried out from 3rd till 24th July, an area of over 1,000 acres being treated. The technique of the work is briefly described. It was found that dusting from a height of 16–20 ft. was the most effective, the width of the effective part of the strip being about 65–100 ft. when the dust was released in " ribbons," or 100–130 ft. when narrower intervals were left between the strips so that they overlapped. Though by flying at a higher altitude, the width of the swath was slightly increased, more dust was carried away by the wind and wasted. Dust released when the leaves were covered with dew adhered much better. Applied at the rate of 2·7–3·6 lb. to the acre, calcium arsenite killed all the larvae of the first three instars on weeds, and the first four on beet within a central strip 16–23 ft. wide, and 40 per cent. of those present on plants covered by the sides of the dust swath. An increase of the dosage did not cause any appreciable rise in the rate of mortality. It was found, however, that calcium arsenite is unsatisfactory for dusting beet, as it caused severe injury to the foliage and in many instances to the roots, so that the weight and sugar content of the crop was considerably decreased.

[Rafes (P.).] **Рафес (П.). Locust Control in the Reed-beds of the Kuban Province.** [*In Russian.*]—*Aviatz. Bor'be Vredit. sel'sk. i lesn. Khoz.* [*Aviation in Control of Agric. & Forest Pests.*] *Mater. 1st All-Union Avio-Chem. Conf. Moscow 1930*, pp. 120–136, 1 fig., 6 tables. Moscow, Sel'kolkhozgiz [Agric. Co-op. Pub.], 1932.

In 1930 a detachment was appointed for aeroplane dusting against *Locusta migratoria*, L., in the reed-beds and flood areas of the Kuban province, where 27 sq. miles were infested with eggs. Large continuous areas infested by hopper bands were dusted in " ribbons," the aeroplane making a series of parallel flights with intervals between them, and completing the square by flying across each end. In this way it was ensured that hoppers, even if not affected by the poison immediately, would sooner or later feed on poisoned vegetation. The dosage of poison (calcium arsenite) was 2·7 lb. per acre, the aperture of the dusting apparatus being adjusted accordingly. The dusting was done in the early morning, and from 6 to 13 loads of dust, each of about 330 lb., were distributed in about two hours of flying. The average area dusted was 144·5 acres during a single flight, and 439 during a flying hour. The altitude of flight was about 33–40 ft., and the width of the dust cloud when it reached the ground was about 330 ft. A central strip 20–26 ft. wide was dusted much too densely and was avoided by the locusts ; on either side were the areas of effective poisoning ; and on the margins were strips about 16–33 ft. wide that were insufficiently dusted. If the aeroplane flew at a height of 10–16 ft., the dusted strip was much narrower and was too densely dusted over nearly half its width.

No hopper bands remained at the end of the campaign, but repeated dusting from the air, as well as ground methods, had to be used to destroy smaller bands. The average cost per unit area of dusting from the air proved to be slightly less than that of spraying from the ground, but the former method is economical only when applied to large continuous areas. Treatment of small areas and of individual bands requires considerable manoeuvring and corresponding loss of flying time.

Calcium arsenite being very fine and light, the dust cloud was broader than in the case of the heavier and coarser sodium arsenite. The cloud is greatly affected by wind, and the altitude of flight should be less when the wind is stronger. Dusting becomes generally ineffective when the wind velocity exceeds 9 miles per hour or with a gusty wind, for the dust does not settle. No scorching of vegetation was caused by the calcium arsenite, but its hygroscopic properties are a great drawback as it becomes damp and unsuitable for dusting unless it is kept carefully packed.

[Potapov (A.).] **Потапов (А.). Locust Control in Daghestan.** [*In Russian.*]—*Aviatz. Bor'be Vredit. sel'sk. i lesn. Khoz.* [*Aviation in Control of Agric. & Forest Pests.*] *Mater. 1st All-Union Avio-Chem. Conf. Moscow 1930*, pp. 136–144, 1 fig. Moscow, Sel'kolkhozgiz [Agric. Co-op. Pub.], 1932.

Five aeroplanes with dusting equipment were sent to control *Locusta migratoria*, L., in Daghestan in 1930. The infested area consisted mainly of swampy inaccessible reed-beds where ground methods of control are impracticable. The organisation of the work is described in some detail. An area of over 200 sq. miles was dusted,

and the aeroplanes made 533 flights, each lasting 20 minutes. The average expenditure of poison per acre was 2·28 lb. and the average area dusted in a flying hour was 464 acres. The number of machines proved to be greater than necessary for the area. The results are not given.

[Tziopkalo (V.).] **Циопкало (В.). Aeroplanes against the Pine Geometrid.** [*In Russian.*]—*Aviatz. Bor'be Vredit. sel'sk. i lesn. Khoz.* [*Aviation in Control of Agric. & Forest Pests.*] *Mater. 1st All-Union Avio-Chem. Conf. Moscow 1930,* pp. 144–158, 4 figs. Moscow, Sel'kolkhozgiz [Agric. Co-op. Pub.], 1932.

In view of the serious damage caused during the last few years to pine forests in the Ukraine by the pine Geometrid [*Bupalus piniarius,* L.], aeroplane dusting with calcium arsenite was carried out from 1st July till 5th September 1930 in the Government of Kharkov, an area of 5,000 acres being treated. The adults were on the wing considerably earlier than usual, appearing at the end of April and being abundant in mid-May. The rate of infestation was calculated by cutting off all the branches from certain trees and counting the eggs ; about 5 per cent. of the eggs were parasitised, and the number of the healthy ones to a crown varied from 56,000 in foci of infestation to 100 in more distant plots. The organisation of the work is described. On an average, the rate of mortality varied from 56 to 92·5 per cent., the dust being usually applied at the rate of 5·4–6·3 lb. to the acre. The cost per acre of aeroplane dusting is shown to be much lower than that of such control measures as the removal of the litter from the forest to destroy hibernating pupae, or the application of adhesive bands to the trees, the economy in labour and time being great.

[Goloviznin (D.), Orlov (P.) & Tzuigankov (S.).] **Головизнин (Д.), Орлов (П.) и Цыганков (С.). The Control of Pests of Cotton.** [*In Russian.*]—*Aviatz. Bor'be Vredit. sel'sk. i lesn. Khoz.* [*Aviation in Control of Agric. & Forest Pests.*] *Mater. 1st All-Union Avio-Chem. Conf. Moscow 1930,* pp. 158–173. Moscow, Sel'kolkhozgiz [Agric. Co-op. Pub.], 1932.

Tests were conducted in July and August 1930 in the former Syr-Daria Province in southern Kazakstan to determine whether aeroplanes can be used for applying dusts against cotton pests and baits against locusts. The work on locusts has already been noticed [*R.A.E.,* A, xix, 371–465]. That in connection with cotton pests dealt solely with the technique of applying the dusts, and not with their effect on the pests themselves. It was found that aeroplanes could be used for dusting with flowers of sulphur against *Tetranychus telarius,* L., nicotine against Aphids and calcium arsenate against *Heliothis obsoleta,* F., and *Laphygma* (*Caradrina*) [*exigua,* Hb.], the most effective results being generally obtained by flying at a height not exceeding 17 ft., though the altitude depends on the nature of the insecticide and the strength of the wind, and may vary from about 10 to 32 ft. The rows of trees with which it is customary to surround cotton fields in Central Asia did not hinder the work of the aeroplane. In a working day of 6–8 hours it was possible to cover an area of about 400 acres, releasing 18 lb. of dust to the acre. The best time for the work was from 4 to 10 a.m., and 8 to 10 p.m. The rate of the precipitation of the various

insecticides was found to depend on the strength of the wind, the fineness of the particles and their cohesion, and the width of the effective swath on the height at which the aeroplane flies, the wind and the composition of the insecticide.

[Suitin (V.).] **Сытин (В.). Control of the Moroccan Locust in Azerbaijan by the Aviomethod.** [*In Russian.*]—*Aviatz. Bor'be Vredit. sel'sk. i lesn. Khoz.* [*Aviation in Control of Agric. & Forest Pests.*] *Mater. 1st All-Union Avio-Chem. Conf. Moscow 1930*, pp. 173–180, 1 fig. Moscow, Sel'kolkhozgiz [Agric. Co-op. Pub.], 1932.

The hilly steppes in the south of the Azerbaijan Republic are subject to annual invasions by *Dociostaurus maroccanus*, Thnbg. Control is usually effected by means of poisoned baits, but transport is very difficult and labour has to be mobilised amongst the population. In 1930 large scale trials of aeroplane dusting were made, over 25,000 acres being treated. The results were satisfactory, 90–100 per cent. mortality of hoppers being obtained when 2·2–3·2 lb. of a mixture of sodium arsenite and calcium arsenite was applied per acre. Pure calcium arsenite was less effective, and hoppers of the later stages were more resistant than the younger ones. Over a hundred acres were dusted in 12 minutes, which was the average duration of a dusting flight. The individual hopper bands and a belt of 50–100 yards wide in front of each of them were dusted. The scouts who found and marked the bands on the previous day were usually on horse-back, but scouting from aeroplanes was very effective, hopper bands being visible on the steppe from the air.

[Sazonov (I. V.) & Stregulina (E. S.).] **Сазонов (И. В.) и Стрегулина (Е. С.). Control of the Red Spider Mite ("Chor") and of the Larvae of the Malaria Mosquito in Armenia.** [*In Russian.*]—*Aviatz. Bor'be Vredit. sel'sk. i lesn. Khoz.* [*Aviation in Control of Agric. & Forest Pests.*] *Mater. 1st All-Union Avio-Chem. Conf. Moscow 1930*, pp. 180–210. Moscow, Sel'kolkhozgiz [Agric. Co-op. Pub.], 1932.

In view of the severe damage caused annually to cotton in the Armenian Republic by *Tetranychus telarius*, L., an attempt was made in July and August 1930 to control it by dusting with flowers of sulphur released from an aeroplane at the rate of 17 lb. per acre. A detailed account of the experiments is given, the results being shown in tables. Work was possible only from 4.30 till 7.30 a.m., as during the day and in the evening ascending air currents lifted the dust cloud and it settled over a much larger area than was originally intended. The height of the flight had to be varied according to the atmospheric conditions, the best altitude being 19–32 ft. Comparative tests of factors affecting the toxicity of the flowers of sulphur to the mite were carried out on the ground. When the dust was applied by means of a hand duster at a rate of 43 lb. to the acre, which proved to be the most effective dosage, it killed in a day an average of 40·6 and 31·8 per cent. of the first and second instar larvae respectively, and 28–29 per cent. of all the subsequent stages. The maximum mortality occurred on the fourth day after the dusting. As regards the influence of irrigation

on the effectiveness of the dust, experiments showed that flooding the fields within a day or two of the treatment considerably decreased its toxic power.

When the dust was applied by aeroplane, the effective swath was not more than 74 ft. wide, and the distribution of dust within it was extremely uneven. At the same time, the percentage of mites killed where three times as much dust as in the ground test had been applied was on an average only 0·6 per cent. higher than in that experiment. The authors consider the poor results of the aeroplane dusting to be due to the apparatus for releasing the dust being unsatisfactory. Moreover, the sulphur tends to form lumps in the apparatus, probably owing to the vibration of the engine, and so cannot be released evenly.

[Orlov (P.).] **Орлов (П.). Experiments in the Control of Orchard Pests.** [*In Russian.*]—*Aviatz. Bor'be Vredit. sel'sk. i lesn. Khoz.* [*Aviation in Control of Agric. & Forest Pests.*] *Mater. 1st All-Union Avio-Chem. Conf. Moscow 1930*, pp. 210–220, 1 fig. Moscow, Sel'kolkhozgiz [Agric. Co-op. Pub.], 1932.

An account is given of experiments in aeroplane dusting carried out from mid-May till mid-June 1930 against *Hyponomeuta malinellus*, Zell., on apple in the north-east of Azerbaijan. The dust applied was calcium arsenate containing 9–23 per cent. of arsenic pentoxide, mixed either with copper carbonate, or with Paris green and flowers of sulphur, so that it might also destroy fungi that were abundant on the trees. The aeroplane flew at a height of 16–32 ft. above the trees, and the maximum width of the swath was 330 ft., that of the effective strip of dust being 100 ft. Daily counts of live and dead larvae and pupae showed that the rate of mortality obtained was on an average very low; the maximum kill (50 per cent. of the larvae and 4 per cent. of the pupae) followed the application of a mixture of 100 parts by weight calcium arsenate, 30 parts flower of sulphur and 2 parts Paris green, used at the rate of 23·4 lb. per acre. None of the mixtures had any effect on the fungi. No damage was caused either to the foliage or the setting fruit.

The experiments indicated that aeroplanes could be successfully used for treating orchards, as the dust descends well on the trees and covers all parts of the crowns as well as when applied from the ground. The failure to obtain a high rate of mortality in these tests was probably due to the low percentage of arsenic pentoxide in the calcium arsenate.

Whitfield (F. G. S.) & Cameron (W. P. L.). **The Sudan Dura Bug, *Agonoscelis versicolor* F.**—*Bull. Wellcome Trop. Res. Lab., Ent. Sect.*, no. 28, 21 pp. multigraph, 5 pls., 10 refs. Khartoum, 1930 [Publ. April 1932].

This is an account of a detailed study of the Pentatomid, *Agonoscelis versicolor*, F., in the Sudan, where it periodically causes very serious damage to millet (*Sorghum*). Descriptions are given of all stages, and its distribution and bionomics are discussed [*R.A.E.*, A, xvii, 657]. Observations on ecology and local distribution show that it is only in the Blue Nile Province that the bug may be found in great numbers, and it is only along a certain stretch of the east bank of the Blue Nile and in the irrigated area of the Gezira that the numbers are such as to produce the clustering habit in the resting season. The bug evidently

prefers districts of moderate rainfall and humidity, 23·6 ins. apparently being too high for rapid reproduction. The indications are that it reaches maximum numbers about every ten years, outbreaks being always associated with a year of heavy rainfall; this would seem natural as the period following a heavy rainy season would produce green food and grain abundantly. Contour, afforestation and grain areas all influence to some extent its distribution, low-lying, shady situations always being preferred by the clustering bugs. They also show a definite selection in their choice of trees for the resting period; isolated groups of trees in the middle of cultivated territory, thick hedges or good shade trees are generally preferred. A list of the favourite forest trees and trees and shrubs in gardens is given; palms alongside irrigation canals are also frequently chosen. For breeding, various weeds and grasses are selected, but very seldom the tree on which the bug has been resting.

Two Scelionid egg parasites occur, namely, *Hadronotus antestiae*, Dodd, and *Microphanurus striaticeps*, Dodd; about 70 per cent. of the eggs were parasitised by the former on one area in 1928, its development requiring 8–10 days. Larvae of Dipterous parasites have been obtained from the adults. Predators include poultry, spiders, ants, Asilid flies and Reduviids.

After the disastrous outbreak of 1927–28, experiments in control measures were undertaken, and the best method of destroying the clustering bugs was found to be by sprays of commercial paraffin used undiluted [*cf.* xviii, 100; xix, 166].

CHIAROMONTE (A.). **La inutilità della disinfestione al calore del seme di cotone, prodotto in luogo, come mezzo di lotta preventiva contro la platyedra** (*Platyedra gossypiella*, **Saund.**) **nella Somalia Italiana.** [The Uselessness of Disinfestation by Heat of locally produced Cotton Seed as a preventive Measure against *P. gossypiella* in Italian Somaliland.]—*Atti 1o Cong. Studi colon., Firenze, 1931*, separate 6 pp. Florence, 1931. [Recd. May 1932.]

As the long-cycle form of *Platyedra gossypiella*, Saund., does not occur in Italian Somaliland [*R.A.E.*, A, xix, 504], heat treatment of locally produced cotton seed is useless. On hatching, the larva enters the green boll, feeds on the seeds therein, and pupates in the soil, in débris, in mature, open bolls, or among cotton-fibres. It does not occur in the seed during the period when there is no cotton in the field.

CHIAROMONTE (A.). **Note intorno alla biologia degli insetti più importanti per la coltivazione del cotone nella Somalia Italiana.** [Notes on the Biology of the more important Insects relative to Cotton Cultivation in Italian Somaliland.]—*Atti 1o Cong. Studi colon., Firenze, 1931*, separate 51 pp. Florence, 1931. [Recd. May 1932.]

These notes deal with insects observed on cotton from November 1925 to November 1926, of which those considered more or less important include, in addition to several noticed previously [*R.A.E.*, A, xix, 504], the Acridid, *Cyrtacanthacris tatarica*, L., which was sometimes parasitised by a Tachinid, *Blaesoxipha anceps*, Villen.; the Gryllids, *Liogryllus bimaculatus*, DeG., and *Scapsipedus marginatus*,

Afz., which fed on young plants as they sprouted; *Coptotermes sjöstedti* var. *subintacta*, Silv., which rarely attacks cotton; the Pentatomid, *Nezara viridula*, L., the eggs of which are often parasitised by the Scelionid, *Microphanurus aloysii-sabaudiae*, Fouts; *Aphis gossypii*, Glov., which is not really injurious; and *Ferrisiana* (*Ferrisia*) *virgata*, Ckll., which is rare on cotton and on bananas was parasitised by *Leptomastix longipennis*, Merc. The Pyrrhocorid, *Dysdercus cardinalis*, Gerst., is one of the most serious pests. The eggs are laid on the ground and covered with earth. They hatch in 6–7 days, the complete life-cycle lasting 26–45. *Hibiscus* is perhaps even more attractive than cotton and is a valuable trap crop.

Lepidopterous pests include the Noctuids, *Prodenia litura*, F., which more usually attacks vegetables; *Diparopsis castanea*, Hmps., which occurs throughout the year but is not common; and *Earias biplaga*, Wlk., and *E. insulana*, Boisd., which do little injury. The Pyralid, *Corcyra cephalonica*, Staint., infests stored cotton-seed and cotton-seed cake. *Acrocercops bifasciata*, Wlsm., mines the leaves and the bracts enclosing the bolls. Though usually unnoticed, it is capable of serious harm to the leaves of young cotton plants. The Buprestid, *Sphenoptera patrizii*, Obenb., mines the stem just above the collar, which may cause the stem to break. It is, however, uncommon. The Eumolpid, *Syagrus rugiceps*, Lef., is a serious pest, the larvae attacking the roots, on which the eggs are laid. The adults, which feed on the leaves, were destroyed in experiments by arsenical sprays and dusts. The larvae of a Melolonthid, *Schizonycha* sp., also attack the roots.

Chiaromonte (A.). **Confronti entomologici, per la coltura del cotone, tra la Colonia Eritrea e la Somalia Italiana.** [An entomological Comparison, regarding Cotton Cultivation, between Eritrea and Italian Somaliland.]—*Atti 1o Cong. Studi colon., Firenze, 1931*, separate 10 pp. Florence, 1931. [Recd. May 1932.]

Insects found on cotton in the Tessenei district in Eritrea, many of which are said to be of quite negligible importance, include the following also recorded from Italian Somaliland [see preceding abstract]: *Sphenoptera patrizii*, Obenb., and *Aphis gossypii*, Glov., which are more common than in Somaliland; *Liogryllus bimaculatus*, DeG.; and *Earias biplaga*, Wlk., which is the only bollworm in Eritrea [*R.A.E.*, A, xviii, 452]. Species not found in Somaliland were the Acridid, *Catantops pinguis*, Stål, attacking the leaves; the Halticid, *Podagrica pallidicola*, Pic; and *Hercothrips* (*Heliothrips*) *indicus*, Bagn., which sometimes proves very injurious.

Chiaromonte (A.). **La valorizzazione agricola delle pendici orientali dell'altopiano eritreo.** [The Agricultural Utilisation of the eastern Slopes of the Eritrean Plateau.]—*L'Ordine fascista*, 1931, reprint 7 pp. Rome, 1931. [Recd. May 1932.]

Few insect pests have been observed on coffee in Eritrea. *Coccus* (*Lecanium*) *viridis*, Green, occurs on the leaves and young twigs; the Pyralid, *Thliptoceras octoguttale*, Feld., attacks the tender seeds in the berries; and a Bostrychid, *Apate monacha*, F., mines in the stems and branches.

Le Pelley (R. H.). **On the Pest-status of certain Coffee-feeding Insects, with Records of some Insects newly recorded from Coffee in Kenya.**—*J. E. Afr. Uganda Nat. Hist. Soc.*, no. 40–41, pp. 67–77, 1 chart. Nairobi, April 1932.

In order to present a more accurate conception of the economic status of certain insect pests of coffee in Kenya, the author subdivides the three categories under which they are commonly classified (*viz.*, major pests, minor pests, and insects that only occasionally or accidentally attack the plant) into further groups. In some of the areas, for instance, where *Pseudococcus lilacinus*, Ckll., is attended by the ant, *Pheidole punctulata*, Mayr, banding [*cf. R.A.E.*, A, xviii, 566] has to be maintained all the year round to prevent severe outbreaks, and the mealybug may be considered a permanent major pest. In certain other areas where it is attended by the same ant, it appears sufficient to maintain the bands only for several months of the year ; in this case it may be considered a frequent major pest, and provision may be made for the application of control measures in anticipation of its outbreaks, which occur more or less regularly. Very occasional attacks of great severity, however, have occurred without any ant attendance, but the cause of such infestations is at present unknown. Apart from the differences due to locality, the status of *P. lilacinus* depends chiefly upon the species of ant attending it, and in a district where it is associated with *Acantholepis capensis incisa*, For., it occurs as a minor pest, though occasionally causing severe outbreaks, the association with the ant not being so highly developed. In localities where it is attended by *Cremastogaster* sp., its attacks are such that no control is necessary, and its status is that of a permanent minor pest. Another common pest is the Pentatomid, *Antestia lineaticollis*, Stål, which at irregular intervals increases over large areas and not infrequently becomes a major pest, sufficiently serious to require the adoption of control measures.

A number of insects are occasional major pests, although they normally occur under the following distinct groups : permanent minor pests, such as Lepidoptera that bore in coffee berries, which include in order of importance *Thliptoceras octoguttale*, Feld., *Deudoryx lorisona*, Hew., *Eucosma nereidopa*, Meyr., and several species recorded below for the first time on coffee ; frequent minor pests, such as cutworms ; and occasional minor pests, such as the leaf-eating caterpillars, *Parasa vivida*, Wlk., and *Odites artigena*, Meyr., and *Asterolecanium coffeae*, Newst. The last-named affects the plant more severely than any other scale-insect, eventually causing its death if the attack is severe. Although the status of *Lygus simonyi*, Reut., is at present uncertain, it is quite probable that this Capsid may prove to be a permanent minor pest that becomes of major importance at certain periods [*cf.* xx, 337].

Insects that do not become pests of major importance, although they may nearly always be found feeding on coffee, are classified as permanent minor pests. They include *Coccus* (*Lecanium*) *viridis africanus*, Newst., and *Leucoptera coffeella*, Guér. The Aphid, *Toxoptera aurantii*, Boy., is also very often present on coffee, but is believed never to have been responsible for severe attacks. The Coccid, *Pulvinaria psidii*, Mask., which seldom occurs on coffee in numbers, and the Pentatomid, *Sphaerocoris ocellatus*, Klug, which does so somewhat more often, are examples of occasional minor pests. Insects the attacks of which are hardly ever sufficiently serious for them to be classified as minor pests include the Flatid, *Cryptoflata unipunctata*, Ol., which is beginning to

adopt coffee as a new food-plant, and *Heliothis obsoleta*, F., and *Locusta migratoria migratorioides*, Rch. and Frm., which only accidentally feed on it.

The following are recorded for the first time as attacking coffee: the Tineids, *Plemyristis oenochares*, Meyr., *Encolpotis xanthoria*, Meyr., and *Pyroderces coriacella*, Snell., all of which have been reared on several occasions in large numbers from coffee berries; *Tortrix dinota*, Meyr., which infests the leaves, shoots and berries; *Blastobasis industria*, Meyr., bred from coffee that has been allowed to dry in the field; *Porthesia aethiopica*, Snell., and the Geometrids, *Epigynopteryx ansorgei*, Warr., and *Cleora tulbaghata*, Feld., which feed on the foliage; *Anthomyia griseobasis*, Mall., which infests the ripe berries; and *Lygaeus electus*, Dist., and *L. bettoni*, Dist., which attack the shoots.

Mossop (M. C.). **Pests of stored Tobacco in Southern Rhodesia.**—*Rhodesia Agric. J.*, xxix, no. 4, pp. 245–265, 2 pls., 8 refs. Salisbury, Rhodesia, April 1932.

An account is given of the bionomics of *Ephestia elutella*, Hb., and *Lasioderma serricorne*, F., infesting stored tobacco in Southern Rhodesia, some of the information being similar to that already noticed [*R.A.E.*, A, xx, 1, 190]. All stages of both insects are briefly described. In the laboratory most of the eggs of *Ephestia* were laid 2–4 days after emergence of the adults, up to 97 being deposited by one mated female. Eggs laid by unmated females failed to hatch. Temperature has an important influence on the lengths of the various stages. Under favourable conditions the larvae, which hatch in 5–10 days, feed for 2–3 months, after which they enter a non-feeding prepupal stage, which normally occupies from 7 days to a month, but may last over 9 months [*cf.* xx, 191]. The pupal period usually occupies 10–20 days in the summer and 18–28 during the time of mass pupation in the spring. *Microbracon hebetor*, Say, was reared from the larvae in Salisbury, as many as 13 individuals emerging from a single host.

The results of preliminary experiments on the control of *Ephestia* were somewhat inconclusive. All attempts to induce the moths to oviposit on articles treated with a mixture of water and chocolate failed. Two sheets of adhesive papers, each 10 ins. square, placed on the top of stacked bales of tobacco caught 64 larvae in 12 days, and two similar sheets with chocolate incorporated in the adhesive material caught 8 moths and 5 larvae in the same period. A total of 13 pupae and 158 larvae were taken in 12 days in 40 ft. of corrugated cardboard strips tacked along a wall 3 ft. from, and parallel to, a row of stacked bales. Batches of eggs exposed to a temperature of 133°F. for 5 minutes in a tobacco drying cylinder in normal operation failed to hatch.

The natural enemies of *L. serricorne* are an unidentified Hymenopterous parasite, and the predacious mite, *Pediculoides ventricosus*, Newp., which has been observed to kill many larvae and pupae.

Various precautionary measures for preventing infestation by *E. elutella* and *L. serricorne* are discussed [xx, 190]. Scrupulous cleanliness on the premises where tobacco is stored or handled is most important, particularly during the spring and summer. Tobacco should be disposed of as quickly as possible, and any retained for local consumption should be stored in an air-tight tank, where it can be

fumigated with carbon bisulphide at the rate of 13 fl. oz. to 100 cu. ft. of space. This high concentration should only be used for tobacco, since it may injure such products as seeds or plants. Maintaining a temperature of 150°F. in the drying room for two hours will kill all stages of the pests. Probably half an hour at this temperature would be sufficient after the tobacco has become properly heated through. An infested warehouse can be kept permanently free from infestation if a system of steam heating is installed; a temperature of 125°F., maintained for 24 hours, will destroy all insects in a warehouse except those hidden deep inside the bales. The fumigant generally used against pests of stored tobacco in Southern Rhodesia is hydrocyanic acid gas. For pests in bales or bulked tobacco a properly closed chamber is necessary; the dosages recommended are at least one "1,200 gram" tin of Citrus Zyklon, or 100 oz. sodium cyanide with the requisite amounts of sulphuric acid and water, for every 1,000 cu. ft. of space, the treatment being maintained for at least 48 hours. For fumigating warehouses $\frac{1}{8}$ or $\frac{1}{10}$ of these dosages may be used.

PETTEY (F. W.). **Removal of Spray Residue from Pears and Apples.**—*Fmg. S. Afr.*, 1932, reprint no. 14, 10 pp., 2 diag., 7 figs. Pretoria, January & February 1932.

This is a revision of a paper already noticed [*R.A.E.*, A, xviii, 26], the information being brought up to date in accordance with recent work on the subject.

F[RAPPA] (C.). **Au sujet de la cochenille des *Opuntia* à Madagascar.**—*Agron. colon.*, no. 172, p. 132. Paris, April 1932.

The author states that the Coccid introduced into Madagascar against *Opuntia* and previously recorded as *Dactylopius coccus*, Costa (*Coccus cacti*, auct.) [*R.A.E.*, A, xv, 523; xvii, 351, 471; xviii, 702] is in fact *D. opuntiae*, Ckll. (*tomentosus*, auct.).

MOUTIA (A.). [**Insect Pests in Mauritius in 1930.**]—*Ann. Rep. Dept. Agric. Mauritius 1930*, pp. 7–10, 2 charts. Reduit, 1932.

Many of the insects reported in Mauritius in 1930 have been previously recorded [*R.A.E.*, A, xix, 505, etc.]. The situation with regard to *Lachnosterna* (*Phytalus*) *smithi*, Arrow, is discussed [see next paper]. The measures against this pest include the night collection of adult beetles and the digging up of larvae. *Tiphia parallela*, Smith, was liberated in 18 centres, and information is being sought regarding another Scoliid, *Elis caracasana*, Rohw., which occurs in Venezuela, with a view to its introduction against *L. smithi*. A species of *Elis* has been introduced from Rodrigues, where it parasitises local species of white grubs, and it has been found to attack *L. smithi* in cages, so that it is hoped that it may adapt itself to this host in the field.

Borers infesting sugar-cane included *Sesamia vuteria*, Stoll (pink borer) and *Diatraea venosata*, Wlk. (*sacchariphaga*, Bojer) (spotted borer). Rice on several plantations was destroyed by the cutworm, *Crambus malacellus*, Dup., for which a number of poison baits were tried without success.

Delord (A.). **Report on the Operations for the Control of *Phytalus smithi* (Arrow) during the Season 1930–31.**—Fol., 8 pp. Mauritius, 1931. [Recd. May 1932.]

During the campaign against *Lachnosterna* (*Phytalus*) *smithi*, Arrow, on sugar-cane in Mauritius in 1930–31, a total of 324 million adults and 64 million larvae were destroyed, as compared with 265 and 137 millions in the previous year [*R.A.E.*, A, xix, 253]. A systematic survey of the Island is summarised in tables showing the average infestation per acre and the highest infestation in various localities as compared with that in the preceding season.

Husain (M. A.), Bindra (S. S.) & others. **Studies on *Platyedra gossypiella*, Saunders, in the Punjab. Part II. The Sources of *Platyedra gossypiella* Infestation.**—*Ind. J. Agric. Sci.*, i, pt. 2, pp. 204–285, 1 graph, 45 refs. Calcutta, April 1931. [Recd. May 1932.]

A detailed account is given of further investigations on *Platyedra gossypiella*, Saund., on cotton in the Punjab carried out from 1926–29 [*R.A.E.*, A, xvi, 628]. The hibernation of the long-cycle larvae is discussed, together with the influence of environmental factors on their development and on the emergence of the moths responsible for the infestation of the new crop, the conclusions reached having already been recorded [xviii, 27]. The authors point out that the control of this pest is dependent on preventive rather than remedial measures and suggest that provision for the treatment of seed in the ginning factories should be enforced by law.

Hutson (J. C.). **Insect Pests and Green Manuring.**—*Trop. Agriculturist*, lxxviii, no. 3, pp. 129–146, 6 pls., 16 refs. Peradeniya, March 1932.

Notes are given on the bionomics and control of the more important insect pests of green manure plants (including cover crops and shade trees) in Ceylon, much of the information being taken from the literature. The general measures recommended are collection and destruction of leaf-eating insects, and lopping and burning of infested parts against sucking insects. Suggestions for the application of appropriate insecticides are given, with formulae for the preparation of simple ones.

Corbett (G. H.). **Entomological Notes. First Quarter, 1932.**—*Malayan Agric. J.*, xx, no. 4, pp. 185–186. Kuala Lumpur, April 1932.

The beetle attacking the roots of mature rubber, recorded in the last quarter's notes as *Leucopholis* sp. [*R.A.E.*, A, xx, 212], has now been identified as *Psilopholis grandis*, Cast., and the Scoliid parasites, of which there are two (not three), are *Campsomeris javana*, Lep., and *C. pulchrivestita*, Cam. In both these species, the egg stage has been observed to occupy about 3 days, the larval 6–7 and the cocoon 27–32.

Larvae of *Chalcocelis fumifera*, Swinh., were unusually abundant in February on coconuts over an area of about 100 acres, this being the first record of heavy infestation by this Limacodid in Malaya. A

number of substances have been tested as attractants for the copra beetle, *Necrobia rufipes*, DeG. Valerianic acid and the mixed fatty acids from coconut and palm oils are apparently more attractive than oleic acid, and wet, mouldy copra than well-prepared or other forms of copra. *Oryctes rhinoceros*, L., which is generally considered to prefer coconut palms, sometimes becomes an important pest of oil palms [*Elaeis guineënsis*]. The eggs are deposited in all kinds of decaying vegetable matter, and such accumulations should be scattered or otherwise disposed of.

Wason (E. J.). **A Moth Pest of Wheat and Oats.** *Ptochostola microphaella* **Walker.**—*Agric. Gaz. N.S.W.*, xliii, pt. 4, pp. 260–262, 1 fig. Sydney, 1st April 1932.

During August, September and November 1930, wheat and oats in three districts of New South Wales were infested by larvae of *Ptochostola* (*Crambus*) *microphaeella*, Wlk. In one of the districts grass was also attacked. No further damage was reported in 1931. The larvae usually feed on grasses, reeds or moss; in the infested areas, which were localised, they were found just under the ground, clustered in and around the butts of the plants. During the day they shelter in silken galleries and at night come above ground to feed on the growing shoots, which are eaten through near the surface of the soil, leaving bare patches in the crop. The pupal period is passed in silken galleries several inches below the ground.

The loss from this Pyralid in one district was estimated at 1 per cent. of the total crop, and there is a possibility that it may become a pest over wide areas. A bait consisting of 24 lb. bran and $1\frac{1}{2}$ lb. sodium arsenite dissolved in 3 gals. water was very effective in control when thoroughly mixed into a crumbly mash and broadcast lightly over the soil.

Ward (K. M.). **The Control of Thrips. Result of Field Tests.**—*J. Dept. Agric. Vict.*, xxx, pt. 3, pp. 113–117, 2 figs., 2 graphs. Melbourne, March 1932.

A serious outbreak of *Thrips imaginis*, Bagn., occurred in Victoria in 1931, lasting from about the first week in October to the first week in December [*cf. R.A.E.*, A, xx, 374]. Experiments were carried out to determine the value of dusts in decreasing the infestation in raspberry flowers sufficiently long to allow the fruit to set. A proprietary dust, consisting mainly of nicotine sulphate in a dolomitic lime base, was applied at the rate of $1\frac{3}{4}$ lb. to 100 plants two or three times a week from the beginning of the flowering period to the time when the thrips had decreased to harmless numbers in the untreated plots. Though it penetrated the blossoms well and caused a mortality of about 90 per cent. of the thrips, the rate of reinfestation (80–85 per cent. of the total prior to treatment being present after 24 hours) was too high to permit satisfactory results. Other dusts containing nicotine or pyrethrum also gave a high degree of mortality but were not sufficiently repellent.

Several natural enemies of *T. imaginis* were observed, including the larvae of *Chrysopa* sp. and of a Coccinellid and the mite, *Anystis baccarum*, L., a number of which destroyed an average of 30 thrips each in a few hours.

Davidson (J.). **Resistance of the Eggs of Collembola to Drought Conditions.**—*Nature*, cxxix, no. 3267, p. 867, 1 fig., 2 refs. London, 11th June 1932.

Smynthurus viridis, L., occurs in large numbers in certain areas of South Australia during the rainy season (May to October). Its numbers rapidly decrease when the dry season sets in and, normally, it does not occur again until about the following May. Certain of the eggs remain dormant in the surface soil during the dry season owing to the lack of moisture. In the course of experiments, it was found that with egg batches exposed to dry conditions for varying periods and then remoistened, the eggs began to hatch in a comparatively short time, showing that some development had taken place prior to their being remoistened. The stage of development prior to the onset of dry conditions is an important factor affecting the number that survive a temporary drought period. Egg batches were kept in moist soil for periods varying between 0 and 7 days, and the soil was allowed to dry for 17 days, at the end of which the moisture content of the surface soil was 2·5 per cent. The soil was then remoistened, and during the following month more than half the eggs hatched, much the highest number hatching in batches that had been kept moist for 4 or 5 days. The relative resistance of the egg at different stages appears to be associated with the changes occurring during development.

The results of experiments on the influence of temperature on the normal incubation period of eggs have been published elsewhere [*R.A.E.*, A, xix, 600].

Hoffmann (W. E.). **The economic Status of the Lygaeids and Notes on the Life History of *Lygaeus hospes* Fabr. and *Aphanus sordidus* Fabr. (Hemiptera, Lygaeidae).**—*Lingnan Sci. J.*, xi, no. 1. pp. 119–135, 2 pls., 13 refs. Canton, 30th March 1932.

The economic status and habits of Lygaeids are discussed from the literature, and an account is given of observations in Canton on the bionomics of *Lygaeus hospes*, F., and *Aphanus sordidus*, F., the nymphs and adults of both of which are described. The former, which the author considers a pest of minor importance, attacks common nightshade (*Solanum nigrum*) and occasionally Cape gooseberry (*Physalis peruviana*) and other plants. Several generations occur in a year, nymphs being present from April to late autumn. *A. sordidus*, which is found from May to August, has only been observed feeding on *S. nigrum*.

Kuwana (I.). **Two new Conifer-infesting Scale Insects from Japan.**—*Philipp. J. Sci.*, xlviii, no. 1, pp. 51–55, 3 figs. Manila, May 1932.

Descriptions are given of *Aspidiotus makii*, sp. n., from *Pinus luchuensis* and *A. pseudomeyeri*, sp. n., from *Juniperus chinensis*. From a comparison of the Japanese forms of *Aspidiotus* infesting conifers with a specimen of *A. abietis*, Schr., from Italy and one labelled as this species from Mississippi, it is concluded that *A. abietis* is not present in Japan. It was discovered that the American specimen was in reality *A. pini*, Comst., and as this Coccid is considered by some authors to be synonymous with *A. abietis*, the distinguishing characters are indicated.

KUWANA (I.). **The Genus *Aclerda* in Japan, including Formosa.**—*Philipp. J. Sci.*, xlviii, no. 1, pp. 57–67, 4 figs., 16 refs. Manila, May 1932.

Aclerda takahashii, sp. n., is described from sugar-cane in Formosa, this species having previously been misidentified as *A. japonica*, Newst. [*R.A.E.*, A, xviii, 706]. *A. tokionis*, Ckll., and *A. biwakoensis*, Kuw., are redescribed from fresh material, and a key to the three species is given.

A very Destructive new Insect Pest of *Citrus* in Porto Rico.—1 p. typescript. Porto Rico Fruit Union, April 1932.

In view of the recent appearance of *Icerya purchasi*, Mask. (cottony cushion scale) in a few groves of *Citrus* in Porto Rico, brief notes are given on its morphology and habits. Infestations have been found on pigeon pea (*Cajanus indicus*), gallege (*Polysias guilfoylei*), *Casuarina*, grapefruit and rose. By scrubbing the infested trees with a strong solution of any of the common soap-oil emulsions used for the control of Coccids and applying at least two sprays at intervals of 7–10 days of an oil emulsion containing not less than 2 per cent. oil, it is hoped to exterminate this pest before it becomes more widely spread and causes serious damage. The second application may consist of fish-oil soap and nicotine sulphate (1–500).

LEONARD (M. D.). **The Pink Bollworm of Cotton in Porto Rico.**—*J. Dept. Agric. Puerto Rico*, xvi, no. 1, pp. 65–73, 1 map, 2 pp. refs. San Juan, January 1932.

Platyedra (*Pectinophora*) *gossypiella*, Saund., was first discovered in Porto Rico in 1921, but remained of little economic importance until 1931, when it increased in numbers throughout the Island and in some fields caused the entire loss of the cotton crop. Alternative food-plants play an important part in influencing its incidence, since they produce fruit throughout the year, so that breeding can continue in the absence of cotton. They include wild tree cotton, which is widely distributed throughout the Island in spite of attempts to eradicate it; *Montezuma speciosissima*, the destruction of which in cotton areas would be impracticable, since it is used as a shade tree and its wood is of commercial value; *Thespesia populnea* which is of minor importance; and okra [*Hibiscus esculentus*], which is only attacked when growing near badly infested cotton.

For several years all cotton seed on the Island has been effectively fumigated under supervision at one centre with carbon bisulphide. The chief difficulty in control, however, is the fact that, owing to differences in rainfall, etc., the planting seasons on the northern and southern coasts are different and cotton is therefore growing in the Island throughout the year. A closed season for cotton has been declared from 10th October to 1st January for the northern coast and from 15th May to 1st August for that of the south.

TUCKER (R. W. E.). **A Survey of the Position of *Phytalus smithi*, Arrow, and its natural Enemies in Barbados.**—*Agric. J. Barbados*, i, no. 1, pp. 18–23. Barbados, January 1932.

Owing to recent reports that *Lachnosterna* (*Phytalus*) *smithi*, Arrow, is increasing rapidly on sugar-cane in Barbados and spreading to new

areas and that the parasite, *Tiphia parallela*, Smith, which has been said to control it in the past, has disappeared, the author has collected a large amount of data concerning the status of both pest and parasite, and has also studied the departmental records of the past twenty years, from which he quotes freely. The last record of the status of *T. parallela* was in 1919–20, when it was thought not to be maintaining effective numbers. There is no evidence, however, that it was ever widely spread in Barbados or very effective in its control of *L. smithi* ; at the present time it is very little in evidence and as a controlling factor would seem to be negligible. Other natural enemies of *L. smithi* include the Scoliid, *Campsomeris* (*Dielis*) *dorsata*, F., which is an occasional parasite, Nematodes, a bacterial disease and green muscardine fungus, but are insignificant in their total effect. The control of the beetle therefore depends on annual co-operative collection of adults and systematic destruction of grubs when cane stools are dug up.

Tucker (R. W. E.). **The Status of *Trichogramma* as a Control of *D. saccharalis* in Barbados.**—*Agric. J. Barbados*, i, no. 1, pp. 29–36, 8 refs. Barbados, January 1932.

In view of recent discussions regarding the value of *Trichogramma minutum*, Riley, in the control of various insect pests [*R.A.E.*, A, xix, 543 ; xx, 141], the author reviews the status of the parasite as used in Barbados, where it is reared and liberated in accordance with an organised plan against a pest (*Diatraea saccharalis*, F., on sugar-cane) that has little alternative host competition and is fairly uniformly distributed over a compact and limited area. The objections that have been raised against the use of the parasite are that it is limited by restricted range of operation and is unable to find its host except by random movements ; that it is not specific to one host so that the controlling effect of artificial increase of numbers is lessened by the overflow of parasite population in unnecessary directions ; that as only a small proportion of the host eggs (estimated at 10 per cent.) survive and eventually produce adults, the number killed by *Trichogramma* is relatively unimportant ; that the numbers of *Trichogramma* normally present in canefields are so great that the numbers added by mass liberation in a given area are relatively insignificant ; and that an increase in the percentage of eggs parasitised by *Trichogramma* is not followed by anything like a similar reduction in the percentage or extent of damage. The author attempts to refute each of these arguments in turn by evidence of the results obtained during the last four years [xix, 720 ; xx, 98, etc.], and considers that control can be secured so long as *Trichogramma* can be mass-reared economically, distributed effectively and timed to achieve maximum effective parasitism.

Olmedo (I. H.). **El Tenthredinido *Neodiprion vallicola* Roh., plaga de los pinos en el Estado de Michoacán, Mexico.** [The Tenthredinid, *Diprion vallicola*, a Pest of Pines in the State of Michoacán.]—*Rev. Ent.*, ii, no. 2, pp. 168–175, 17 figs., 5 refs. S. Paulo, 31st March 1932.

Of recent years pine forests in the State of Michoacán, Mexico, have been infested by *Diprion* (*Neodiprion*) *vallicola*, Roh., about 60,000 acres being attacked in 1930. The trees are usually killed by the larvae, and as most of them are young they yield little timber. Brief

descriptions are given of the larva and both sexes of the adult sawfly. *Pinus ayacahuite* and *P. leiophylla* intermingled predominate in the forests, but only the former is attacked. Larvae and cocoons collected in March produced adults in June and July. Adult life did not exceed 10 days in the laboratory. The duration of the egg stage was not observed, but must be long, as larvae occurred from November to March. The larvae fed voraciously on pine needles exclusively and required about 2 months for development, with 5-6 moults. The prepupal and pupal stages are passed in a cocoon at a depth of 2 inches in the ground. Of the 419 adults bred, 348 were females, so that parthenogenesis probably occurs; this might explain the scarcity of the sawfly in certain years. Three species of Hymenopterous parasites were obtained, as well as an undescribed Tachinid of the genus *Spathimeigenia*, 20·8 per cent. of the prepupae being parasitised. Cost precludes control by spraying or dusting, but the numbers of parasites might be increased by breeding in insectaries. On the first appearance of an incipient infestation, the larvae could be collected by hand.

Pinto da Fonseca (J.) & Autuori (M.). **Lista dos principaes insectos que atacam plantas citricas no Brasil.** [A List of the chief Insects attacking *Citrus* in Brazil.]—*Rev. Ent.*, ii, no. 2, pp. 202–216. S. Paulo, 31st March 1932.

Notes are given on the appearance and in some cases the bionomics of the principal pests of *Citrus* in Brazil, showing their distribution there. In addition to 33 Coccids, the species dealt with are the leaf-cutting bee, *Melipona ruficrus*, Latr., attacking the leaves and flowers; the Trypetids, *Ceratitis capitata*, Wied., and *Anastrepha fraterculus*, Wied.; *Lonchaea pendula*, Bezzi, which infests fruits already attacked by these flies; the Melolonthids, *Macrodactylus suturalis*, Mannh., and *M. affinis*, Cast., the adults of which do considerable injury to the flowers in November and December; the Curculionids, *Cratosomus reidi*, Kby., and *C. fasciatus*, Perty; the Cerambycids, *Diploschema rotundicolle*, Serv., *Coleoxestia spinipennis*, Serv., *Rhopalophora collaris*, Germ., and *Trachyderes succinctus*, L.; the Lamiids, *Macropophora accentifer*, Ol., and *Leptostylus pleurostictus*, Bates; *Papilio anchisiades*, Esp., *P. androgeus*, Cram., *P. lycophron*, Hb., and *P. thoas*, L.; the Limacodid, *Sibine nesea*, Stoll; *Megalopyge lanata*, Cram.; the Tortricid, *Gymnandrosoma aurantianum*, Costa Lima; the Aphid, *Toxoptera aurantii*, Boy.; the Aleurodids, *Hexaleurodicus jaciae*, Bondar, *Paraleyrodes singularis*, Bondar, *Dialeurodes struthanthi*, Hempel, and *Aleurothrixus floccosus*, Mask.; and *Heliothrips haemorrhoidalis*, Bch., and *Frankliniella insularis*, Frankl.

Siegler (E. H.) & Munger (F.). **Preparation and Use of chemically treated Corrugated Bands as a supplemental Control for the Codling Moth.**—*E. 294* (no. 278 revd.), multigraph, 7 pp., 5 pls. Washington, D.C., U.S. Dept. Agric. Bur. Ent., 1st April 1932.

This paper contains practical information on the preparation and use against the codling moth [*Cydia pomonella*, L.] on apple of bands treated with beta-naphthol (1 lb. dissolved in 1½ U.S. pints lubricating oil) to render them toxic to the larvae sheltering in them. The oil should be of a viscosity of 300 Saybolt since it evaporates less rapidly and makes a more tenacious coating than one of lower viscosity. Bands of paper 2 ins. wide and corrugated on one side are recommended.

Treated bands should not be applied to young trees with smooth bark, as they are liable to cause injury. The optimum time for their application can be ascertained by the daily examination of bands of burlap or cloth placed round a few trees in a warm, sheltered situation. They should be fixed in time to trap the first larvae migrating from the fruit and not removed until late winter or early spring. They may sometimes be used in and around packing houses, cider mills or other places where apples are handled in considerable bulk.

A description is given of an apparatus for the treatment of the bands, by means of which they are coated with the solution at the rate of about one ounce to every linear foot in two dippings at a temperature of 265–270°F., the bands being cooled between the treatments.

King (W. V.) & Cook (W. S.). **Feeding Punctures of Mirids and other Plant-sucking Insects and their Effect on Cotton.**—*Tech. Bull. U.S. Dept. Agric.*, no. 296, 11 pp., 3 pls., 5 refs. Washington, D.C., April 1932.

A detailed description is given of experiments, some of which have been previously noticed [*R.A.E.*, A, xviii, 64], that were carried out in Louisiana during three years for the purpose of studying the lesions produced in stems and petioles of cotton by *Psallus seriatus*, Reut., and other plant-sucking insects, and determining whether they were due to a tranmissible virus or to chemical injury. The character of the lesions caused by the feeding is described in detail.

The following is taken from the authors' summary: Practically all punctures resulted in the same type of internal injury; lesions that swelled and broke open seemed to be the result of more extensive injury rather than injury of another kind. The feeding of 10 different species (5 Capsids, 2 Lygaeids, 2 Jassids and a Membracid) was observed. The average severity of the damage by different species was variable. The percentage of split lesions was 32·6 for *Lygus pratensis*, L., and 9·5 for *P. seriatus*. *Poeciloscytus basalis*, Reut., which is seldom taken on cotton, caused external swellings at every feeding point and produced the highest percentage of split lesions (58·2). Of all the individuals that fed more than once, only two failed to produce the injury at some feeding point. The feeding punctures of the three species of Homoptera were traceable through the tissues by a well-defined sheath, similar in appearance to that observed in the case of Aphids [xi, 250; xii, 162], the paths usually ending in the vascular tissue. No sheath material was found about the punctures made by Capsids; at the most a few ruptured cells were observed. Since all the species tested cause a reaction in cotton stems similar to that produced by *P. seriatus*, the indications are that the damage is due to injected substances normally present in the insects and toxic to the plant, rather than to a transmissible disease.

Daniel (D. M.). *Macrocentrus ancylivorus* **Rohwer, a polyembryonic Braconid Parasite of the Oriental Fruit Moth.**—*Tech. Bull. N. Y. St. Agric. Expt. Sta.*, no. 187, 101 pp., 18 figs., 16 refs. Geneva, N.Y., January 1932. [Recd. May 1932.]

An account is given of the results of the colonisation of *Macrocentrus ancylivora*, Rohw., for the control of *Cydia* (*Grapholitha*) *molesta*, Busck (oriental fruit moth) in peach orchards in Niagara County, New York,

with material obtained from New Jersey during the period 1928–31 [*R.A.E.*, A, xviii, 68; xix, 361, etc.]. As the result of the liberation of 43 colonies, all of which became successfully established, parasitism by *M. ancylivora* averaged 21·7 per cent. out of a total parasitism of 38·7 during the four years. A list is given of 20 parasites found during the investigations, of which six have not previously been recorded as attacking *C. molesta* in North America, *viz.*, *Omorgus* (*Campoplex*) sp., *Ichneutidea secunda*, Rohw., *Meteorus trachynotus*, Vier., *Angitia rosanae*, Vier., *Microdus* (*Bassus*) *rubripes*, Cress., and *Apanteles cacoeciae*, Riley. A description of the stages of *M. ancylivora* is given, and its biology is discussed in detail, the process of polyembryonic development being described. Polyembryony, however, appears to be of no benefit to the species, as only one larva matures in a single host.

The following is taken from the author's summary: The eggs of this Braconid are laid throughout the summer in the body cavity of the host larvae and hatch in 110–140 hours at a temperature of 80°F. The winter is passed as a mature first stage larva in the body cavity of the host, which has already spun its cocoon. Feeding and development are recommenced in the spring. At the fourth stage the larva emerges and feeds externally on the host, consuming all but the exoskeleton. Pupation takes place in a cocoon within that of the host. Three or four generations of *M. ancylivora* occur annually on *C. molesta*, and two or three on the strawberry leaf-roller [*Ancylis comptana*, Fröl.].

Bourne (A. I.) & Whitcomb (W. D.). **Department of Entomology.**— *Bull. Massachusetts Agric. Expt. Sta.*, no. 280 (Ann. Rep. 1931), pp. 213–220. Amherst, Mass., February 1932.

Notes are given on work on the control of insect pests in Massachusetts during 1931. A nicotine-soap spray reduced the numbers of the onion thrips [*Thrips tabaci*, Lind.] on seed onions from 1,200 to 125 per 100 plants in one instance, and from 3,250 to 190 in another. The plum curculio [*Conotrachelus nenuphar*, Hbst.] caused serious injury to apples during the hot period between 27th May and 1st June. It was, however, less active than usual throughout the season as a whole, only 1,618 mature larvae emerging from a bushel of unsprayed, dropped apples as against an average of 2,854 for the three preceding seasons. In investigations on hibernation, no weevils survived when buried in wire cages 3–12 ins. below the surface of the soil. A few remained alive in cages having a protection of leaves. All immature stages were killed when confined in constant temperature cabinets at 55°F., and development was greatly retarded at 65°. The most favourable temperature was 75°, development being slightly more rapid than at 85°. The greatest number of feeding and egg punctures of adults were produced at 75°. Beetles confined with poisoned fruit died most quickly at the higher temperatures. At all temperatures the average length of life decreased with each increase in concentration of lead arsenate up to 6 lb. in 100 U.S. gals water, when there was a slight increase, indicating a repellent action. The most effective concentration appeared to be 5 lb. in 100 U.S. gals., which was only slightly better than 4 lb.

Investigations on the carrot rust fly [*Psila rosae*, F.] showed that when pupae were confined at constant temperatures, 68 per cent. of the flies emerged at 55° and 65°F., 42 per cent. at 75° and none at 85°.

The percentage of emergence decreased according to the moisture of the soil from 70 at 25 per cent. saturation to 2·5 at 100. The average date of emergence was retarded consistently from 19th May with 25 per cent. saturation to 25th May with 100 per cent., only one individual surviving in the extremely wet soil. The flies lived longest at 55°F. but laid the greatest number of eggs at 65°. Both soot and tobacco dust, applied to the crowns of carrots and the soil around them at the rate of about 5 lb. to each 180 ft. of row, gave almost complete control, and slightly stimulated the growth of the plants.

Vapourised naphthalene was tested as a fumigant against greenhouse pests. In an airtight chamber, the fumes from 1½ oz. melted naphthalene to 1,000 cu. ft. space killed 93 per cent. of the red spider [*Tetranychus telarius*, L.] in 6 hours, but 2–3 oz. with an exposure of 4 hours are necessary under normal greenhouse conditions to obtain any appreciable degree of control. Under ideal conditions all the eggs were killed by two treatments of 3 oz. to 1,000 cu. ft.; 12·5 per cent. hatched after one fumigation, as compared with 89 per cent. of unfumigated eggs. Eggs 4–5 days old were more susceptible than those recently deposited. Three or four fumigations are often necessary to obtain a satisfactory kill of *T. telarius*, an interval of 1 day between treatments being more effective than one of 2–3. At a relative humidity of 90 per cent. there was a tendency for the plants to be injured, the most favourable conditions being 80 per cent. humidity and a temperature of 80°F. The addition of 15 per cent. paradichlorobenzene to the naphthalene tended to increase the effectiveness of one application, but this mixture and naphthalene alone were equally effective in 2–3 applications. Thrips are easily killed by naphthalene, and Aphids and Aleurodids are controlled by two or more good fumigations. Mealybugs are very resistant, and the fumes will not penetrate the soil sufficiently to kill bulb mites [*Rhizoglyphus hyacinthi*, Boisd.]. Exposed cyclamen mites [*Tarsonemus pallidus*, Banks] are killed by three or more fumigations.

O'Kane (W. C.) & Westgate (W. A.). **Sodium Soaps of the normal saturated Fatty Acids. Contact Performance on Paraffin and on the Larva of the Meal Worm,** *Tenebrio molitor*, **Linn. Studies of Contact Insecticides iv.**—*Tech. Bull. New Hampshire Agric. Expt. Sta.*, no. 48, 4 pp., 2 graphs. Durham, N.H., March 1932.

This paper, which is one of a series [*R.A.E.*, A, xix, 121, 122, 584], deals with a study of the sodium soaps of the normal saturated fatty acids in which the contact angles of successive concentrations were determined, both on slides coated with paraffin wax and on the integument of the larva of the mealworm, *Tenebrio molitor*, L. The materials used and the technique employed are described. A table shows in summarised form the contact angles photographed and measured, and two graphs prepared from this show the trend of the performance of successive concentrations of the soaps studied, on paraffin and on the mealworm. Sodium myristate was found to be too slightly soluble to give records beyond an exceedingly low concentration. The graphs demonstrate that on the whole the contact performance of soaps at lower concentrations parallels the length of the carbon chain, and that an increase in the length of the carbon chain is accompanied by an increase in the contact quality of the soap either on paraffin wax or on

the mealworm. Contact performance therefore appears to be definitely related to adsorption phenomena. The line indicating sodium myristate has the steepest incline of all; it does not attain the lowest angle of contact but this is probably due to its limit of solubility. In the series of soaps tested, sodium laurate gave the maximum performance within the range of concentration included in the graphs, as indicated by the minimum angle of contact on both wax and mealworm. It does not follow, however, that it will invariably give optimum performance as a contact agent in the case of all insects, since the nature of the integument is not always the same.

McGregor (E. A.). **The Ubiquitous Mite, a new Species on** *Citrus*.—*Proc. Ent. Soc. Wash.*, xxxiv, no. 4, pp. 60–64, 1 pl., 6 refs. Washington, D.C., April 1932.

Tydeus ubiquitus, sp. n., is widely distributed on *Citrus* throughout California. It is not phytophagous, its food consisting of insects present on the foliage. Although the occasional occurrence of the mite under mature reproducing scales [*Coccus pseudomagnoliarum*, Kuw., and *C. hesperidum*, L.] at first led to the belief that it might be a true predator, it is concluded, through lack of evidence to the contrary, that it confines its feeding chiefly to dead bodies of insects and non-viable eggs.

[**Insect Pests in New Mexico in 1930–31.**]—*42nd Ann. Rep. New Mexico Agric. Expt. Sta. 1930–31*, pp. 32–37. State College, N.M. [1932].

The results of four years' experiments in New Mexico with baits for the codling moth [*Cydia pomonella*, L.] are reviewed [*cf. R.A.E.*, A, xx, 27, etc.]. As in the previous winter [xix, 477] corrugated paper bands treated with beta-naphthol or alpha-naphthylamene proved toxic to overwintering larvae, killing 98–99 per cent. in 3 months and 100 per cent. in 6; double dipping of the bands, and using aluminium stearate as an activator increased the effectiveness of beta-naphthol. Para-dichlorobenzene and granular calcium cyanide were both effective soil fumigants for killing larvae hibernating at the base of the tree trunk.

Douglass (J. R.). **The Control of the Bean Beetle in New Mexico.**—*Bull. New Mexico Agric. Expt. Sta.*, no. 199, 14 pp., 14 figs. State College, N.M., February 1932.

Epilachna corrupta, Muls., is the most serious pest of beans in New Mexico. It may be controlled by dusting with calcium arsenate (alone or mixed with 3 parts hydrated lime) at the rate of 4 lb. to the acre, or spraying with 2 lb. calcium arsenate in 100 U.S. gals. water, with or without the addition of 4 lb. hydrated lime. The insecticides are best applied against the overwintered beetles before the larvae begin to appear, since at this period the beetles are concentrated and less numerous than at any other time of the season. In any case they should be directed to the lower surface of the leaves, where alone the adults and larvae feed, and preferably be used under dry conditions to avoid foliage injury. Beans for human consumption should not be treated after the pods have set. Suitable spraying and dusting equipment is discussed.

Crane (H. A). **Observations and Notes on Pear Mite, generally known as** *Eriophyes pyri.*—*Mon. Bull. Dept. Agric. California,* xxi, no. 2–3, pp. 214–217. Sacramento, Cal., 1932.

From observations in California, it appears that in addition to *Eriophyes pyri,* Pag. (pear mite), a second species of this genus, which causes serious injury to the buds, is present in pear orchards [*R.A.E.*, A, xvii, 73, 228]. Three applications of lime-sulphur (as a dormant spray in autumn and spring and as a cluster bud spray), which is effective against *E. pyri,* failed to control this species, but satisfactory results were obtained when an additional cluster bud spray (4–5 per cent. lime-sulphur) was applied.

Pettit (R. H.). **Insect Damages Chippewa County Pea Crop.**—*Quart. Bull. Mich. Agric. Expt. Sta.*, xiv, no. 2, pp. 87–89, 2 figs. East Lansing, Mich., November 1931. [Recd. May 1932.]

Cydia (*Laspeyresia*) *nigricana,* Steph. (pea moth) has comparatively recently been introduced from eastern Canada into Michigan, where it is now established in a district in which the growing of peas constitutes an important industry. Its bionomics and control are discussed [*cf. R.A.E.*, A, viii, 532]. The most satisfactory single control measure is the rotation of crops ; new crops of peas should be grown at least a quarter of a mile from the previous year's fields.

McDaniel (E. I.). **Imported Rose Stem-girdler attacks Roses.**—*Quart. Bull. Mich. Agric. Expt. Sta.*, xiv, no. 2, pp. 89–91, 3 figs., 1 ref. East Lansing, Mich., November 1931. [Recd. May 1932.]

Since its introduction into America in 1913, the Buprestid, *Agrilus communis* var. *rubicola,* Abeille, has become generally established on rose in the north-east of the United States. It has been erroneously recorded there as *A. politus,* Say [*R.A.E.*, A, iii, 132] and, frequently, as *A. viridis* var. *fagi,* Ratz., a European species that attacks beech. It prefers to feed on *Rosa rugosa* or roses grafted on this stock, but has been found on wild rose and various cultivated varieties. There is one generation annually, the adults appearing in June and ovipositing on the bark of the stems. The larvae bore a continuous spiral girdle, 1–4 ins. long, in the sapwood, causing the death of the stem above this point. The bark over the gall sometimes splits longitudinally, and the stems break readily at the point of injury. When the pest is numerous, there are usually several galls to a stem. The larvae hibernate in the sapwood or the pith and pupate in the spring. The only practical method of control is to cut and burn all infested rose stems before the adults emerge in the spring.

Hutson (R.). **Leaf Tier damages Celery.**—*Quart. Bull. Mich. Agric. Expt. Sta.*, xiv, no. 2, pp. 91–93, 1 fig. East Lansing, Mich., November 1931. [Recd. May 1932.]

During September 1931, considerable damage was caused to celery in Michigan by *Phlyctaenia rubigalis,* Gn. (*ferrugalis,* auct.), the larvae of which feed on the leafy tops and about the base of the petioles of the plants. The life-cycle lasts 4–6 weeks, and there are apparently four generations a year under field conditions.

Satisfactory commercial control was obtained by two applications, at an interval of 30 minutes, of pyrethrum in the form of a fine dust or as a spray. The insecticide should be directed into the centre of the leaf-cluster, and the first application causes sheltered larvae that would not otherwise be killed to crawl out so that they are exposed to the second. The dust may be made of equal parts of pyrethrum with talc, chalk, bentonite or infusorial earth, and the addition of 1 oz. good quality neutral soap per U.S. gal. increases the efficiency of the spray. About 100 U.S. gals. spray or 25 lb. dust are usually required to an acre for each application. Neither sprays nor dusts can be depended upon to kill larvae infesting celery already "in the bleach." Washing the celery for market does not remove them, and they continue to feed and foul it afterwards, but tests showed that the addition of standard pyrethrum liquid preparations in the washing water at strengths approximately half those recommended for use in the field caused almost complete mortality and did not affect the edibility of the celery.

Fumigation of Flour Mills by Hydrocyanic Acid Gas generated from Cyanegg (R & H Sodium Cyanide 96–98%).—32 pp., 7 figs. New York, The Roessler & Hasslacher Chem. Co., 1932.

This booklet contains a comprehensive account of the process of fumigating flour mills with hydrocyanic acid gas generated by means of sulphuric acid and a commercial brand of sodium cyanide, manufactured in egg-shaped pieces each weighing about 1 oz.

Smith (R. C.). **The Control of the Pea Aphid in Alfalfa Fields with special Reference to the Chain Drag.**—*J. Econ. Ent.*, xxv, no. 2, pp. 157–164, 1 pl., 3 refs. Geneva, N.Y., April 1932.

A brief account is given of the history of *Macrosiphum* (*Illinoia*) *pisi*, Kalt., and of the results of the attacks of this Aphid on lucerne in Kansas. Results obtained in various control methods, experiments with which are described, are practically identical with those already noticed from California [*R.A.E.*, A, xiv, 652]. The deaths of Aphids in any numbers owing to the sun and heat have never been observed in Kansas, and fungous diseases are apparently of less importance as a control factor there than in California. Cultural practices reported as promising in California, which are dependent largely on irrigation, are either inapplicable or offer no hope of control in Kansas, and winter pasturing of lucerne is not practised there. Nicotine sulphate sprays and dusts, and the use of harrows, field roller, cultipacker and brush drag failed to give satisfactory control. Burning, although a theoretically correct control, is difficult, expensive and of doubtful value. The use of calcium cyanide flakes broadcast in or at the margins of breeding centres at the rate of 30 lb. or more to the acre, followed by jarring the Aphids to the ground, produced a kill of 85–90 per cent. The flakes should be broadcast about mid-day when the plants and the surface of the soil are dry and the air temperature about 70°F. or higher. Tests carried out over four seasons with aphidozers [*cf.* xviii, 314] show that 30–90 per cent. (according to the height of the lucerne) of the Aphids present may be collected by them. The author considers the aphidozer to be the most effective control device available for infestations on tall lucerne, which in Kansas occurs near the end of the outbreak, at the end of April or beginning of May. However, Aphids do

less damage on tall than on early growth, and predators become a controlling factor about that time.

A new implement, called the chain-drag, has proved effective in controlling *M. pisi* on lucerne 3–6 ins. high. It consists of a platform of planks 6 ft. by 3 ft., held together by three iron runners underneath, to which the planks are bolted, the front ends of the two outer runners being curved to form the hitch. The front edge of the platform is rounded, and a sheet iron lip is nailed on so that it extends above the platform about ½ inch. One series of drag chains 2–3 ins. apart is stapled on at the bottom of the platform, and a second series to a bar held by angle-iron braces 4 ft. behind the platform. The chain-drag is pulled by 2 horses, and the driver stands on the platform, well forward, to keep the front edge low. Infested lucerne was dragged and then cross-dragged, an estimated reduction in infestation of 50–60 per cent. being effected by this means. The drag was not satisfactory on growth taller than 10 inches. Injury to the lucerne plants was confined to the leaves or stems, and the plants generally straightened up overnight after treatment.

PARKER (J. R.) & SHOTWELL (R. L.). **Devastation of a large Area by the Differential and the Two-striped Grasshoppers.**—*J. Econ. Ent.*, xxv, no. 2, pp. 174–187. Geneva, N.Y., April 1932.

During the summer of 1931 grasshoppers destroyed 75 per cent. of the crops over an area of 17,000 sq. miles and 25 per cent. of the crops over an additional 13,000 sq. miles in south-central North Dakota and north-eastern Nebraska. *Melanoplus bivittatus*, Say, and *M. differentialis*, Thos., were responsible for at least 95 per cent. of the injury, the latter species slightly predominating. Details are given of the life-history and seasonal damage caused. The eggs began to hatch during the second week in May in the case of *M. bivittatus*, and the development of *M. differentialis* was about two weeks later throughout the season. Small grains and lucerne were among the first crops attacked, maize being little damaged while these were available, but in July when the hoppers transformed to the winged stage large areas of maize in the neighbourhood of these crops were rapidly destroyed. *M. bivittatus* was ovipositing by 15th July and *M. differentialis* by 1st August. Oviposition continued even in November.

Poisoned bran mash gave excellent kills wherever properly applied, but was not obtainable at the right time. It could not be used successfully after the grasshoppers had reached the winged stage. Its manufacture on a commercial scale was undertaken for the first time and proved to possess a number of advantages. Aeroplanes were used effectively in scattering the bait over large acreages in a short time so that advantage could be taken of the feeding period, which seldom exceeds 3 hours in a day.

In preliminary tests in which a bait of 100 lb. bran, 2 U.S. qts. liquid sodium arsenite (4 lb. material), 2 U.S. gals. cane molasses and 12 U.S. gals. water was compared with a dust of 1 lb. sodium arsenite and 2 lb. talc, the former gave an average of 78 per cent. mortality and the latter 69 per cent., both being applied at the rate of 10 lb. to the acre. The dust costs twice as much as the bait and caused considerable scorching of green barley.

Comparisons showed that about 11, 18 and 90 acres respectively can be covered in an hour by distributing bait from a wagon, a motor

truck, or an aeroplane. A very even and effective distribution was obtained from aeroplanes.

Maximum feeding of grasshoppers on poisoned bran mash took place most commonly at air temperatures of 75–85°F. The hoppers spent the night high up on vegetation. When the sun had started to warm the surface of the soil, they descended to the ground and remained there until the soil became too hot, subsequently seeking the shaded side of clumps of vegetation and climbing to a resting position several inches above the ground. On cloudy mornings they remained inactive ; and some of the heaviest kills were obtained when bait was scattered at the first clearing of the skies. Thus movement towards the ground that marks the beginning of feeding on poisoned bran mash was not limited by temperature alone, but the end of the feeding period was invariably at air temperatures between 90 and 95°F. except during migrations, when temperature limits of feeding are higher. Studies during the last two weeks of July showed temperature limits to be the same for adults of both species, without differing materially from those reported for the hoppers. Feeding slackened at 86°F. and ceased at air temperatures above 90°F. or soil-surface temperatures above 112°F.

Migrations of hoppers, which were common from 10th to 29th June, were observed as early as 9.45 a.m. and as late as 6 p.m., between the temperatures of 77 and 99°F. A cloud darkening the sun was sufficient to stop migration instantly. Migrating hoppers usually fed readily at any temperature when poisoned bran mash was scattered across their line of march, and excellent kills were obtained. Short flights of adults in all directions occurred when air temperatures reached 86–90°F., increasing as the temperature rose and being augmented by any swirl of wind. A few grasshoppers were seen flying as high as 1,400 ft., but the majority fly below 600. These flights were not true migratory movements, but were apparently due to restlessness caused by high temperatures, the insects being in search of cooler conditions. Definite mass movements of adults, consisting of short low flights of 10–100 yds., did, however, occur at about 80°F. in their search for green food. *M. differentialis* showed stronger powers of flight than *M. bivittatus* and was more active on the ground. It also required more heat for its development, the hopper stage being 4–9 days longer at the same temperatures. This is borne out by the fact that the northern limit of *M. differentialis* is northern Minnesota and southern North Dakota, whereas *M. bivittatus* extends well into Canada. Another important difference between the two species is the capacity for sudden enormously increased destruction possessed by *M. differentialis* as distinct from *M. bivittatus*, which develops more regularly and is less responsive to temperature.

The warm autumn of 1931 allowed females to lay a maximum number of eggs, which began the winter in excellent condition. As very few insect enemies were present, there is every reason to expect serious trouble over an even larger area in 1932.

RUGGLES (A. G.). **Observations on a Grasshopper Outbreak in Minnesota.**—*J. Econ. Ent.*, xxv, no. 2, pp. 187–189. Geneva, N.Y., April 1932.

With a view to obtaining statistical information concerning the results of poison bait for the control of grasshoppers on a large scale, a survey of 123 heavily infested farms was carried out in Minnesota in

1931. The autumn egg survey showed conclusively that considerably less oviposition occurred on areas where bait had been applied during the summer. The formula used was 100 lb. bran, 5 lb. crude white arsenic, 2 U.S. gals. black strap molasses and 10 U.S. gals. water. The average loss to crops from grasshopper attack was 28·85 per cent. on the baited acreage and 76·26 per cent. on the unbaited. About £5,500 was spent on grasshopper control in Minnesota in 1931, and it is estimated that for every shilling spent on bait, crops to the value of £5 were saved.

Drake (C. J.) & Decker (G. C.). **The Role of the Airplane in Grasshopper Control.**—*J. Econ. Ent.*, xxv, no. 2, pp. 189–196, 2 pls., 2 refs. Geneva, N.Y., April 1932.

In experimental work in grasshopper control in western Iowa in July, August and September 1931, 200,000 lb. of poison bran mash was applied by aeroplane at the rate of 20 lb. (10 lb. dry bait) to the acre. The most prominent species concerned were *Melanoplus differentialis*, Thos., *M. bivittatus*, Say, *M. femur-rubrum*, DeG., and *M. mexicanus*, Sauss. Two aeroplanes broadcast 20,000 lb. of mash each morning between 5.30 and 9.20 a.m. A commercial bait, consisting of 80 per cent. bran, 15 per cent. molasses and 5 per cent. crude arsenic, prepared by feed mixer and blender, was used. It was distributed very evenly, without danger of poisoning farm animals. A second man in the aeroplane beside the pilot regulated the flow of mash from the sack. The air blast from the propeller scattered the bait so that it fell mainly as individual flakes upon the ground and vegetation. Three sacks of mash, each containing 120–140 lb., were carried on each trip. The plane flew on an average 20–50 ft. above the ground and so could treat 10–15 rows of maize at a time. The advantages of distribution of bait by aeroplane are : greater rapidity of treatment ; greater uniformity of distribution, with decreased danger to farm animals ; absence of damage to crops by trampling by man, horses or vehicles ; possibility of treating areas otherwise inaccessible ; and saving of time by preparation of large quantities of bait at one place. Some of the disadvantages are : the costliness of the treatment, which renders it impracticable for small areas ; difficulty in securing easily accessible landing fields, especially before harvest ; difficulty in obtaining aeroplanes with experienced pilots at reasonable rates ; and the fact that the hire of the aeroplane demands a cash outlay and does not permit of the use of available labour to best advantage. The aeroplane, including pilot and assistant to scatter the bait, was secured by contract for £5 per flying hour, or rather more than the rate for commercial flying. When it operates within 2 miles of a good landing field, the cost of broadcasting should not exceed 6*d.* an acre, but the development of mechanical devices to regulate the feed and flow of the mash from the aeroplane, thus obviating the necessity of carrying a second man, should reduce this cost by about 25 per cent. For large areas the use of a larger aeroplane would admit of carrying a larger load of bran and effect a reduction in cost.

Bigger (J. H.). **Short Rotation fails to prevent attack of *Diabrotica longicornis* Say.**—*J. Econ. Ent.*, xxv, no. 2, pp. 196–199, 2 refs. Geneva, N.Y., April 1932.

In the course of experiments carried out in Illinois since 1928 in order to determine the effect of rotations on certain insects infesting

the roots of maize, a three-year rotation of maize, oats and sweet clover has failed to control *Diabrotica longicornis*, Say (corn root worm) and has been abandoned owing to serious damage by this beetle.

Drake (C. J.), Travis (B. V.) & Collins (E. V.). **A preliminary Report on the Control of White Grubs with a Rotary Plow.**—*J. Econ. Ent.*, xxv, no. 2, pp. 199–206, 2 pls., 4 diag. Geneva, N.Y., April 1932.

Lachnosterna (*Phyllophaga*) spp., which first appeared in the north-east corner of Iowa in 1909 and since then have spread to the south and west, are now among the most serious insect pests in the State. They tend to concentrate in the more hilly, broken and wooded areas, where a considerable acreage of land is in permanent bluegrass pasture [*Poa*], timothy grass [*Phleum pratense*] being also grown. Mechanical experiments in control by means of a rotary plough were conducted in southern Iowa in 1930 and 1931 in virgin bluegrass pasture, timothy sod and old maize stubble, 96·7 per cent. of the grubs being killed during the operation and most of the remainder dying within 6 days. The percentage of grubs reached by the plough varied with the date in autumn or late spring on which the work was done. A study of the literature and of a collection of 20,000 larvae and adults has been made to determine the relative importance of the 31 species of white grubs involved. This has shown that the same species predominate in broods A, B and C, *L. fusca*, Froel., *L. futilis*, Lec., *L. hirticula*, Knoch, *L. rugosa*, Melsh., and *L. implicita*, Horn, being the most abundant, and *L. crassissima*, Blanch., *L. fraterna*, Harr., *L micans*, Knoch, *L. inversa*, Horn, and *L. tristis*, F., being present in large numbers. Data were also secured for the population and downward and upward migrations in autumn and spring respectively of brood A. The average population in a virgin 88-acre bluegrass pasture was 181,863 grubs to the acre, the most heavily infested spot yielding 223,245 grubs to the acre. In the transformation and hibernation studies it was found that only 4 per cent. of the insects were within plough depth during the pupal and adult stages. About 3 and 43 per cent. of the white grubs in two bluegrass pastures, 6 per cent. of those in maize, and 7 per cent. of those in timothy sod were parasitised by Scoliids.

Baerg (W. J.) & Palm (C. E.). **Rearing the Rough-headed Corn Stalk-beetle.**—*J. Econ. Ent.*, xxv, no. 2, pp. 207–212, 3 refs. Geneva, N.Y., April 1932.

Ligyrus (*Euetheola*) *rugiceps*, Lec. (rough-headed corn stalk-beetle) is a local pest in Arkansas, where under certain conditions the stand of maize is destroyed in numerous localities scattered over a large part of the State. An account is given of rearing experiments carried out in 1930 and 1931. Oviposition studies showed that one female may deposit 100 eggs over a period extending from 8th July to 26th August, and the egg-laying capacity may be even greater. During 1931, 410 eggs were obtained between 13th June and 28th August, indicating that the period of oviposition may cover 3 months.

In view of the increase observed by other workers in the size of the eggs, daily measurements of six eggs were made for 10 days from oviposition to hatching, and the eggs were weighed on the date of oviposition and 8 days later. An average total increase in length and width of 1·5 times was recorded and an average increase in weight of

3·1 mgm. The average incubation period was 9·85 days in 1930 and 12 days in 1931, when the temperature was lower. The authors found the vegetable mould used as larval food by other workers unsatisfactory, and they adopted for rearing experiments a mixture composed of equal parts of a fairly light sandy soil rich in humus and a heavy loam found in low spots where *Juncus* grows, keeping it moderately moist in flower pots. The moisture content that proved most satisfactory for larval development averaged 18·74 per cent. The larvae were kept in salve boxes in which the soil was changed every other day, and after reaching the second instar were supplied with several kernels of sprouted maize, on which they fed, chiefly on the contents of the endosperm. Most of the larvae were reared in a pit, in which they occupied a position 3 ft. below the surface of the ground where the daily fluctuations in temperature were very small and relative humidity was 90 per cent. The larvae were successfully reared under these conditions although a few were killed by a fungus and others were attacked by mites. During the latter part of the season some of the pupae suffered from a disease, possibly a bacterial infection, that became increasingly serious as the weather grew cooler in autumn. Data are given concerning the length of the larval instars and of the pupal stage. The combined larval and pupal periods of 44 individuals ranged from 51 to 104 days. The development period for many individuals in the field is probably somewhat shorter.

MARCOVITCH (S.) & STANLEY (W. W.). **Experiments on the Control of arsenical Injury on Peach.**—*J. Econ. Ent.*, xxv, no. 2, pp. 213–217, 1 pl., 10 refs. Geneva, N.Y., April 1932.

The following is taken from the authors' abstract and summary: In view of the fact that severe defoliation of peach trees following the application of four lead arsenate sprays occurred in a locality of poor fertility in Tennessee in 1930, whereas in more fertile locality no scorching was produced by the same spray schedule, a series of experiments was carried out to test the effect of fertilisers in overcoming arsenical spray injury. It is now generally believed that arsenic poisons the cell through its reaction with the SH group of glutathione. Since this material is closely allied with the growing process, nitrogenous fertilisers were used to stimulate growth, and in all cases reduced the injury to a minimum as compared with that on unfertilised trees. It is suggested that a tree showing increased growth is well supplied with an abundance of SH groups, which are believed to be natural antidotes to arsenical poisoning.

ISELY (D.) & SCHWARDT (H. H.). **The Rice Water Weevil Problem in Arkansas.**—*J. Econ. Ent.*, xxv, no. 2, pp. 218–222, 4 refs. Geneva, N.Y., April 1932.

Lissorhoptrus simplex, Say (rice water weevil) occurs in large numbers in Arkansas, where it is the only generally distributed pest of rice and as such is frequently held responsible for short yields and killing of crops with which it is in no way connected. Being an insect of the temperate zone, it only attacks rice, which is a tropical plant, where the respective ranges overlap. Hence in Arkansas it is more numerous and important than in Louisiana, where its presence has been found not to affect the yield of the grain or straw [*R.A.E.*, A, xix, 18]. An attempt has therefore been made to determine the degree of its destructiveness in

the former State. The highest average infestation found in counts of adult weevils on rice plants was 14 per sq. ft. in Arkansas, as compared with 2 in Louisiana. The larvae feed on the roots of the rice.

In large cage experiments the yield of rice in uninfested cages was approximately 35 per cent. greater than in cages artificially infested. Rice fields are invaded by swarms of adult weevils immediately after flooding. They are usually most abundant during the first week after flooding and gradually decline in numbers for 5–6 weeks, after which there is a sudden increase, probably indicating a newly matured generation. In June or July first instar larvae are found among the roots within 8 days, and cocoons have been found within 23 days and pupae within 26 days after flooding. The pupal period may be as short as 7 days. The larvae feed most heavily in the third instar, which is reached 14 days after flooding, when rarely less than 10 larvae are present on a plant. The average number of larvae to a plant in plots of late rice in mid-August 1930 was 16·6. Within 3–4 weeks after flooding, the number of larvae feeding among the roots declines, but 6–7 weeks after flooding, larvae of the first and second instars again occur in large numbers and a second period of infestation, suggesting a second generation, follows. A few larvae may be found in the fields until September, but apparently cause no damage to the roots. The loss caused by *L. simplex* may be reduced by drainage at the time when the majority of the larvae have entered the third instar, and before severe root pruning begins. Drainage should continue until the soil is thoroughly dried. About 75 per cent. of the larvae were killed in drainage experiments carried out in 1931, but in view of the cost of reflooding and certain agronomic disadvantages the value of drainage is doubtful. Yields on plots drained 21–24 days after flooding were in all cases higher than those of undrained plots and, to a less degree, higher than those of plots drained 14–18 days after flooding. Yields on plots that remained drained for 19–29 days were higher than those on plots that remained drained for only 2 weeks.

Herms (W. B.). **Insect Parasitology.**—*J. Econ. Ent.*, xxv, no. 2, pp. 222–232. Geneva, N.Y., April 1932.

The following is practically the author's summary : The study of insect parasitology offers much of interest to workers in the various fields of entomology. An understanding of the sucking mechanism with its chemical products and the effect of these on plant or animal tissue is a matter of prime importance. The problem of host specificity and host range are matters of concern to biological control. The study of insect parasitology becomes most significant in relation to the transmission of micro-organisms pathogenic to animal or plant life. This relationship remains incomplete without a knowledge of reservoir animals or plants. The curricular requirements for adequate training in the field of insect parasitology are not now met through the channels of entomology alone. The insect parasitologist should first of all be a fundamentally well-trained biologist.

O'Kane (W. C.). **Some Problems and Development in Control of Insects by Chemicals.**—*J. Econ. Ent.*, xxv, no. 2, pp. 232–243. Geneva, N.Y., April 1932.

The following is taken from the author's summary : A review of the development of the use of chemicals in the control of insects shows that

many materials now used in sprays were suggested or used thirty or more years ago, and some have been in use for over a hundred years. The introduction of new pests and the spread of others introduced earlier have to some degree prevented the recent great advance in the knowledge of measures for the control of plant pests from reaching its full potentiality. Thus out of a recent list of 64 outstanding pests, only 24 are recognised as yielding to really satisfactory control. Recommendations for the use of materials already known 50 years ago are nevertheless much more exact to-day than they were formerly, and a noteworthy advance has been made in accurate knowledge of the performance of various chemicals. A substantial beginning has also been made in the fundamental study of insect physiology as related to the effect of chemicals. Some noteworthy chemical compounds have been devised, especially among substitutes for ordinary arsenicals. These include both complex organic substances derived from plants by extraction and other materials developed in chemical laboratories.

The extensive research departments of various large chemical industries are now working in co-operation with the entomologist and plant pathologist to discover new and potent compounds and to synthesise needed materials. There is reason to hope that new and more effective materials will shortly be available, especially among contact insecticides, but also among fumigants, stomach poisons and, probably, attractants and repellents.

Herrick (G. W.) & Griswold (G. H.). **Fumigation of the immature Stages of the Clothes Moths and Carpet Beetles with a Mixture of Ethylene Dichloride and Carbon Tetrachloride.**—*J. Econ. Ent.*, xxv, no. 2, pp. 243–248, 1 ref. Geneva, N.Y., April 1932.

In experiments carried out for over a year, a mixture composed of three parts by volume of ethylene dichloride to one part by volume of carbon tetrachloride [*cf. R.A.E.*, A, xvi, 86], when applied at the rate of 2 fl. oz. to 5 cu. ft., proved toxic to the eggs and larvae of *Tineola biselliella*, Humm., and to the larvae of *Attagenus piceus*, Ol., and *Anthrenus verbasci*, L., when confined for 48 hours in an ordinary trunk, even at temperatures somewhat below 70°F. Larvae of *T. biselliella* were also killed by this fumigant when confined in a tight cupboard, though at temperatures somewhat above 70°F. The liquid is clean, has a pleasant odour, will keep indefinitely in a tight container, and promises to be a suitable household fumigant. It is non-inflammable and non-poisonous to man.

Lindgren (D. L.) & Shepard (H. H.). **The Influence of Humidity on the Effectiveness of certain Fumigants against the Eggs and Adults of *Tribolium confusum* Duv.**—*J. Econ. Ent.*, xxv, no. 2, pp. 248–253, 6 graphs, 6 refs. Geneva, N.Y., April 1932.

In view of considerable variations in results of experiments on the relative toxicity of various fumigants to different stages of *Tribolium confusum*, Duv., tests were carried out with ethylene oxide, carbon bisulphide and chlorpicrin to determine the effect of humidity on their toxicity. The methods of Strand [*R.A.E.*, A, xx, 60] were followed with certain modifications. The toxicity to the adults was unaffected by ordinary variations in relative humidity, but dry air conditions reduced materially the effect of chlorpicrin and carbon

bisulphide on the eggs. Under all the moisture conditions tested ethylene oxide was more effective against the eggs of *T. confusum*, whereas carbon bisulphide and chlorpicrin were more so against the adults. Contrary to the generally accepted view that the egg is a particularly resistant stage, ethylene oxide appears to be nine times as toxic to the eggs as to the adults. Median lethal concentrations of the three materials under low and high humidity conditions are shown in a table for both adults and eggs.

Hockenyos (G.) & Lilly (J.). **Toxicity Studies of hypodermic Injection of *Celerio lineata* Larvae.**—*J. Econ. Ent.*, xxv, no. 2, pp. 253–261, 1 pl., 8 graphs, 10 refs. Geneva, N.Y., April 1932.

A technique developed for the direct injection of insecticides into the bodies of insects, thus eliminating the extra factor of absorption, is described for use on large larvae. Nearly mature larvae of *Celerio lineata*, F., were used on account of their size, uniformity and temporarily abundant supply, and most of the experiments were made with 40 per cent. nicotine sulphate, though several other materials were tried for comparison. A B-D tuberculin hypodermic syringe graduated to 0·01 cc. and equipped with a 27 gauge $\frac{3}{4}$ inch platinum needle was used to administer the injections. The procedure developed consisted in making a puncture in the body wall, slightly to one side of the mid-dorsal line on the second thoracic segment, with a sharp dissecting needle and inserting into it the hypodermic needle with its point extending posteriorly into the larva for $\frac{1}{2}$ inch just beneath the body wall. Distilled water was used for preparing all dilutions, and 0·05 cc. was the volume selected for most of the injections.

The data secured, which are presented in graphs, indicate that for both organic and inorganic materials there often appears to be an optimum point of dilution at which they can be most efficiently used. Thus 0·0006 cc. of pure nicotine was injected in one case as 0·03 cc. of 2 per cent. dilution and in another case as 0·06 cc. of 1 per cent. dilution, the latter proving consistently more efficient than the former. Some possible reasons for this are suggested. The speed of paralysation of a larva injected with nicotine sulphate of a given dilution was in direct proportion to the distance from the point of injection to the head. Thus larval muscle co-ordination is shown to be centred in the brain.

Bulger (J. W.). **Additions to our Knowledge of the Toxicity of Stomach Poisons to Insects.**—*J. Econ. Ent.*, xxv, no. 2, pp. 261–268, 1 pl., 2 graphs, 7 refs. Geneva, N.Y., April 1932.

A study of the effect of calcium hydroxide, calcium caseinate, precipitated sulphur, dry Bordeaux mixture and hydrated ferric oxide on the toxicity of acid lead arsenate for the fourth instar silkworm [*Bombyx mori*, L.] was carried out by means of the sandwich method [*R.A.E.*, A, xviii, 311], but with certain improvements designed to control the quantity and distribution of the dust and to save time. Although no remarkable effect was produced by any of these substances, it is fairly certain that calcium hydroxide and calcium caseinate increase the toxicity of lead arsenate when mixed with it in approximately equal proportions by weight. The indications are that precipitated sulphur may increase the toxicity of acid lead arsenate and that dry Bordeaux mixture and hydrated ferric oxide may decrease it.

Experiments were also made by the sandwich method on the relative susceptibility to acid lead arsenate of the last instar larvae of *Malacosoma americana*, F., *Hyphantria cunea*, Drury, *Datana integerrima*, G. & R., and *Ceratomia catalpae*, Boisd. With the median lethal dose as the standard of comparison, the first two insects were less susceptible and the last two more susceptible than the fourth instar larvae of *B. mori*. It was also shown that, although the median lethal doses of acid lead arsenate and cuprous cyanide are different for *C. catalpae* and *B. mori*, their relative toxicity is about the same for each of these insects.

FLINT (W. P.) & FARRAR (M. D.). **The Use of Mineral Oils for better Dusts.**—*J. Econ. Ent.*, xxv, no. 2, pp. 269–271. Geneva, N.Y., April 1932.

In the course of experimental work on the oriental fruit moth [*Cydia molesta*, Busck] in Illinois, it was found that the adhesiveness of dusts applied to peach trees could be improved by the addition of small quantities of mineral oil. Mineral oils of from 80 to 110 seconds viscosity have been found most desirable for dusting mixtures. White or saturated oils may be used, but unsaturated or so-called straw oils have not caused injury. In laboratory, greenhouse and orchard tests carried out in 1929 and 1930 with apple, peach, potato and other plants, no injury resulted from the use of various dusting materials combined with light lubricating straw oils. It has not been found practical to combine more than 5 per cent. by weight of oil with the dust, and in order to combine this percentage with sulphur dusts, it is necessary to replace a part of the sulphur with hydrated dusting lime or other deflocculative material in order to give the mixture sufficient buoyancy. Extensive tests of oil dusts on peaches have shown them to be superior to other materials, including standard sprays. No arsenical injury has occurred, and the growth of the tree has been excellent. Although they give fairly good control of the second brood of *C. pomonella*, L., these dusts do not equal sprays in this respect, but they give as good results as those obtained with any other material against *C. molesta*, and the control of curculio [*Conotrachelus nenuphar*, Hbst.] afforded by them was equal to that obtained with the standard sprays.

In order to effect a thorough mixture of the oil throughout the dust, which cannot be satisfactorily done in the ordinary hopper mixer, the oil should either be added to a small amount of the mixed materials and then fed into a standard dust mixer, or sprayed in the form of a fine spray into the hopper as the other materials are being added. Oil dusts have remained in excellent condition when stored in sacks for over two years.

MCGOVRAN (E. R.). **The Effect of some Gases on the tracheal Ventilation of Grasshoppers.**—*J. Econ. Ent.*, xxv, no. 2, pp. 271–276, 10 refs. Geneva, N.Y., April 1932.

Carbon dioxide, carbon bisulphide, hydrocyanic acid gas and nicotine in certain concentrations increased the volume of air inhaled into the tracheal system by the respiratory movements of a number of grasshoppers. Minimum lethal concentrations of HCN and CS_2 temporarily increased the tracheal ventilation, but this was followed by a gradual decrease as the insect became less and less active.

HEADLEE (T. J.). **Further Studies of the Effects of Electro-magnetic Waves on Insects.**—*J. Econ. Ent.*, xxv, no. 2, pp. 276–288, 1 pl., 1 chart, 3 refs. Geneva, N.Y., April 1932.

The following are the author's summary and conclusions: The controlling factors in the effect of radio waves upon certain insects and certain plants seem to be frequency and current volume. The two are intimately combined but the frequency appears to furnish the selective agency and the current volume to provide the punch. Soils develop heat when subjected to radio waves. The amount of heat developed is largely dependent upon the amount of water present. Dry soils heat slowly and wet soils heat rapidly. Water under treatment with radio waves increases in heat slowly but definitely.

As regards light waves, irradiation of the foliage wall of the apple tree in the amount of 10 foot-candles during first brood activity of the codling moth [*Cydia pomonella*, L.] resulted in approximately 50 per cent. reduction in fruit injury by that insect. Increasing the light energy delivered from the violet end of the spectrum seems to increase the normal oviposition activity of the moth. Increasing the light energy delivered from the red end of the spectrum seems mainly to induce an abnormal activity, which is more or less aimless and not necessarily accompanied by oviposition. Activity begins shortly after the sunlight has fallen to 30 foot-candles. In all probability an irradiation of a little more than 30 foot-candles would be necessary during favourable evenings and mornings to prevent the codling moth from ovipositing.

FELT (E. P.) & BROMLEY (S. W.). **Insecticides on Shade Trees and Ornamentals.**—*J. Econ. Ent.*, xxv, no. 2, pp. 298–304. Geneva, N.Y., April 1932.

The following is taken from the authors' summary: In the course of tests in Connecticut during the autumn of 1930 and the spring of 1931 to determine the tolerance of various shade trees and shrubs to dormant oil sprays, the sugar maple [*Acer saccharum*], black walnut [*Juglans nigra*], butternut [*J. cinerea*] and beech were found to be very susceptible to oil injury, and certain conifers were apt to be injured where excessive amounts were used. Other trees and shrubs sprayed with various oils at dormant strength were not injured.

Dormant oil, 1 : 16, was very effective in killing the overwintering young of *Toumeyella liriodendri*, Gmel. (tulip tree scale). *Chermes* (*Adelges*) *pinicorticis*, Fitch (white pine bark Aphid) was very satisfactorily controlled with a dormant oil at 1 : 25 or 1 : 50 and one at 1 : 50 to which was added 40 per cent. nicotine sulphate, 1 : 800. Tests of several commercial sprays applied to spruce branches in which the latter were immediately covered with paraffined paper bags resulted in no appreciable injury, indicating that high humidity was probably not an important factor in causing injury.

It was found that a lead arsenate coated with lead oleate, which had proved much more effective against *Popillia japonica*, Newm., than ordinary lead arsenate, was equally effective when applied to twigs upon which adults of *Scolytus quadrispinosus*, Say (hickory bark beetle) were feeding. A spray of 2 per cent. summer oil with the addition of nicotine sulphate, 1 : 800, and a commercial vegetable oil, soap and nicotine sulphate mixture, diluted 1 : 10, gave practically

100 per cent. kill of *Diaspis carueli*, Targ. (juniper scale) in midsummer. Control varying from 95 to 100 per cent. was secured with a number of insects by the application of the vegetable oil, soap and nicotine spray.

HAMILTON (C. C.). **Spraying and Dusting Experiments for the Control of Leafhoppers infesting Dahlias and Asters.**—*J. Econ. Ent.*, xxv, no. 2, pp. 304–311, 6 graphs. Geneva, N.Y., April 1932.

Tests during the summer of 1930 with pyrethrum sprays and dusts, nicotine sprays and dusts, white oil sprays of four viscosities, these same four white oils impregnated with copper oleate, a sulphonated oxidised oil, and Bordeaux sprays showed that all were effective in killing *Cicadula sexnotata*, Fall., on asters and *Empoasca fabae*, Harr. (*mali*, LeB.) on dahlias except the Bordeaux sprays. The Bordeaux sprays and the pyrethrum dusts were the only materials tested that acted as repellents to the leafhoppers, and all sprays were safe upon the plants with repeated applications except the white oils, which, when used alone or impregnated with copper oleate, caused scorching to the foliage of asters.

Tests in 1931 with pyrethrum sprays and dusts and Bordeaux sprays showed that heavy applications of Bordeaux sprays or of a pyrethrum dust applied dry or as a spray were effective in repelling *E. fabae* for 4–5 days. Nicotine dusts were of only slight value as repellents. The best control of leafhoppers was secured by constructing 6 ft. cheesecloth cages around groups of plants, supplemented with an occasional dusting with pyrethrum. The leafhopper population in the treated plots was reduced to zero at each treatment, but was built up almost to that of the check plots within 5 days owing to migration from outside sources. If it is not practicable to construct cages, heavy applications of Bordeaux at a strength of 4–4–50 or more, or of a pyrethrum dust applied dry or as a spray will prevent leafhopper injury. Applications should begin as soon as the plants are set out and be repeated at intervals of 4–5 days until they start to form buds.

SMITH (F. F.) & WEIGEL (C. A.). *Taeniothrips gladioli* **M. & S., a new Pest of Gladiolus.**—*J. Econ. Ent.*, xxv, no. 2, pp. 312–318, 2 pls., 3 refs. Geneva, N.Y., April 1932.

Serious injury to *Gladiolus* frequently reported in 1931 from several of the north-eastern United States and Canada was found to be mainly due to *Taeniothrips gladioli*, Moult & Steinw. [*R.A.E.*, A, xix, 310], although *Aeolothrips fasciatus*, L., *Frankliniella fusca*, Hinds, and another species of *Frankliniella* were also present on the injured plants. The injury consists of silvering of the foliage and malformation and streaking of the flowers. The food-plants of *T. gladioli*, which are somewhat restricted, include *Tritonia* sp., *Tigridia* sp. and *Kniphofia* sp. The adults feed on the exposed portions of the plants, and the larvae in secluded and protected places. Injury to the seed pods has resulted in failure of the plants to produce seeds, and stored corms have also been attacked. The loss of flowers in some cases amounted to 95 per cent. Development seems to continue throughout the growing season, as all stages were present during the period of observation. The eggs are inserted in plant tissue in the leaf sheaths and other protected parts. Larvae pupated in flowers and leaf sheaths when infested material was confined in boxes, but large numbers of pupae were found

in the soil after harvest during October. The pupae are unprotected by any pupal cells. Although a moist condition appears to be necessary for them, many were found drowned by water from recent rains filling up crevices in which they occurred. Pupae collected on 26th October had all produced adults on 3rd November, and it is probable that the pupal stage is much shorter when the temperatures are higher. If this thrips hibernates out-of-doors, it probably does so in the adult stage, as the pupae seem too delicate to withstand the winter, but the presence of all stages in stored corms indicates that it passes the winter in them, and this also accounts for its wide dissemination.

The only natural enemy observed was a predator, *Orius insidiosus*, Say, nymphs and adults of which were seen to feed on all stages of the thrips. The most practical control measures are probably those applied to the corms in storage, as the thrips are protected when feeding on the plants. Those suggested are fumigation with hydrocyanic acid gas or carbon bisulphide, or immersing the corms for 15–20 minutes in a solution containing 1 oz. free nicotine to 3 U.S. gals. water or for one hour in a nicotine and soap solution. None of these treatments are likely to affect the eggs, and they would have to be repeated when the eggs have hatched. Submerging the corms in hot water, which has been successfully used against *Pseudococcus maritimus*, Ehrh., on *Gladiolus* [*R.A.E.*, A, xvi, 269], may also prove satisfactory, in which case the eggs also would probably be killed and one treatment would be adequate.

Smith (F. F.). **Injury to Hollyhock and Marigold by the Potato Leaf Hopper, *Empoasca fabae* (Harris).**—*J. Econ. Ent.*, xxv, no. 2, pp. 318–321, 2 pls., 1 ref. Geneva, N.Y., April 1932.

During the season of 1931, a type of injury to leaves of hollyhock (*Althaea rosea*) and African marigold (*Tagetes erecta*) similar to the hopperburn injury on potato was observed in several areas in the eastern United States. Marigold in gardens showed a curling and reddening of leaflets and twisting of petioles, and also killing of young shoots. Since large numbers of leafhoppers of the genus *Empoasca* were feeding on the plants, these insects were suspected of being responsible for the injury. To test this possibility nymphs developing on hollyhock, marigold and *Zinnia* were reared to the adult stage and all males after use in tests on caged plants were identified as *Empoasca fabae*, Harr. By confining adults in micro-ring cages on petioles of the young leaves of plants grown from seed or by clonal reproduction, wilting or the more slowly developing types of injury, depending on the number of insects used, were produced in the leaf beyond the point of feeding. Although *E. fabae* was entirely responsible for the injury described in this case, other species may be involved in other areas. Heavy infestations of *Myzus persicae*, Sulz., did not occasion the injury. Adults of *E. erigeron*, DeLong, produced stippling of the foliage typical for this species.

Thomas (C. A.). **Observations on Mushroom Insects.**—*J. Econ. Ent.*, xxv, no. 2, pp. 322–331, 1 ref. Geneva, N.Y., April 1932.

This paper, which summarises the biology and control of Diptera and Collembola injuring cultivated mushrooms in Pennsylvania, is an abridged version of part of a paper already noticed [*R.A.E.*, A, xx, 301], the information on mites being omitted.

BURDETTE (R. C.). **Attraction of certain Insects to Spray Baits.**—*J. Econ. Ent.*, xxv, no. 2, pp. 343–346, 1 ref. Geneva, N.Y., April 1932.

Tests carried out in New Jersey in 1931 showed that adults of *Spilographa electa*, Say (pepper maggot) were attracted to an invert sugar syrup used at the rate of 6 lb. to 50 U.S. gals. water as a bait-spray on peppers [*Capsicum*]. As in previous tests, cane sugar failed to attract the flies. The use of lead arsenate at the rate of 1½ lb. or zinc arsenite at the rate of 1 lb. to 50 U.S. gals. spray was accompanied by a reduction in the number of flies. The bait was found to be equally attractive to *Heliothis* (*Chloridea*) *obsoleta*, F. (corn ear worm), but the addition of insecticides failed to kill any of the moths, though it did not inhibit the attractiveness of the spray. In order to make use of this attractant as a control for *H. obsoleta*, a material must be used that will have a very rapid effect on the moths, as a slow killing poison will leave time for oviposition before it takes effect. If a suitable killing agent can be found, the attraction of moths to a few rows of maize in the field will possibly afford a control measure for the protection of sweet maize.

THOMPSON (F. M.). **Pine Oils as Agents for protecting rustic Furniture and Log Cabins from various Wood Borers.**—*J. Econ. Ent.*, xxv, no. 2, pp. 347–351, 3 refs. Geneva, N.Y., April 1932.

The following is substantially the author's abstract. Certain combinations of fractions of pine oils, when sprayed on the bark of rustic furniture and log cabins made of white cedar, are very efficient in killing the larvae of the Cerambycids, *Anocomis* (*Hylotrupes*) *lignea*, F., *Oeme rigida*, Say, and *Callidium antennatum*, Newm., working in the wood, and the Scolytid, *Phloeosinus dentatus*, Say, which was found in considerable numbers causing numerous shot-holes in the outer bark. They will prevent infestation of the wood for a period of at least one summer season following treatment, with no appreciable effect on the colour of the bark.

HARTZELL (F. Z.). **Relation of Shelter to Abundance of Pear Midge.**—*J. Econ. Ent.*, xxv, no. 2, pp. 351–355. Geneva, N.Y., April 1932.

Data and analysis of orchard environment collected from studies of individual orchards in New York in 1930 and 1931 are given, apparently confirming the fact that infestation of pears by *Contarinia pyrivora*, Riley, varies inversely with the distance from the source of shelter from wind [*R.A.E.*, A, xix, 403].

PARROTT (P. J.). **The Oriental Fruit Moth in New York.**—*J. Econ. Ent.*, xxv, no. 2, pp. 355–360, 3 refs. Geneva, N.Y., April 1932.

The history of *Cydia* (*Grapholitha*) *molesta*, Busck (oriental fruit moth) in New York is briefly summarised, and a short account is given of the present conditions in the two peach-growing areas of that State, where infestation has spread rapidly since it was first discovered in 1926. In the neighbourhood of original infestations in western New York injury to the peach crop ranges from 7 to 18 per cent., and in areas of more recent establishment from 3 to 35 per cent. Quinces in Niagara county are 100 per cent. infested. The position with regard

to insecticides and parasites is discussed, the unsatisfactory nature of the present control measures is pointed out, and the necessity for a study of the problem with a view to developing more effective methods is insisted upon. Doubt is cast on the efficacy of breeding and distributing parasites so long as no definite knowledge is available as to the total number required to produce the desired effect. Even where parasitism is exceedingly high, the host in many cases succeeds in destroying the crop.

ALLEN (H. W.). **Present Status of Oriental Fruit Moth Parasite Investigations.**—*J. Econ. Ent.*, xxv, no. 2, pp. 360–367, 1 ref. Geneva, N.Y., April 1932.

The following is the author's summary: Owing to severe damage caused by *Cydia* (*Laspeyresia*) *molesta*, Busck, and to the fact that generally effective artificial control methods have not yet been devised, considerable attention has been given to the parasites that have in certain areas proved capable of partly controlling the host. Parasites of *C. molesta* are known to occur in Europe, Australia and Japan. Work has been under way since 1929 with the European parasites, 8 species of which have been imported, 7 liberated, and one (*Pristomerus vulnerator*, Panz.) recovered to date. One species (*Perisierola*) has been imported from Australia, and it is hoped that two other important species (*Gambrus stokesii*, Cam., and *Antrocephalus pomonellae*, Cam.) will shortly be received. Investigations of the possibility of obtaining valuable species from Japan will start in 1932.

It is considered that there is a possibility of doing valuable work in distributing indigenous species from centres where they are abundant to localities in which they are not known to occur. During the past three years, a large number of *Macrocentrus ancylivora*, Rohw., have been reared and distributed in all heavily infested centres. Recoveries have been made from nearly all these centres, although the evidence now available points to favourable results only in more restricted areas. Mass liberations have been chiefly concerned with *Trichogramma minutum*, Riley, from which rather unfavourable results have been obtained in southern New Jersey. Considerable work has been done with the parasites of *C. molesta*, most of which is too recent to permit a reliable estimation of results. It is hoped that careful studies of the various parasites will reveal their limitations and suggest methods by which their usefulness may be extended by following certain cultural methods. It seems unlikely that a very considerable proportion of the various leads attempted will yield valuable results, but success with only a portion of them would go far towards reducing the importance of *C. molesta* as a pest.

MCCONNELL (H. S.). **Oriental Fruit Moth Parasites in Maryland.**—*J. Econ. Ent.*, xxv, no. 2, pp. 367–370, 2 refs. Geneva, N.Y., April 1932.

A list is given of parasites of *Cydia* (*Laspeyresia*) *molesta*, Busck, recorded in Maryland, with notes on their relative importance and distribution in the State. An extensive survey of the parasites of *Ancylis comptana*, Froehl., has shown that the only ones common to it and to *C. molesta* are *Microbracon gelechiae*, Ashm., *Hoplocryptus incertulus*, D.T., *Lixophaga variabilis*, Coq., and *Macrocentrus ancylivora*, Rohw., but a less thorough study of those of *Epiblema strenuana*,

Wlk., indicates that the latter is an important host of certain parasites of *C. molesta* [*R.A.E.*, A, xix, 204]. Up to the present *M. ancylivora* has been the chief parasite in all parts of the State except the western mountain section, where *Glypta rufiscutellaris*, Cress., is the most abundant. *M. delicatus*, Cress., is the second most important species in the central portion, but assumes a minor rôle in the eastern part. *Trichogramma minutum*, Riley, has been numerous in various parts of the State under certain conditions, expecially where there is a heavy deposition of eggs on apple or quince. Cases have been observed where 90 per cent. of the larvae of *C. molesta* in peach twigs have been parasitised by 1st August and yet 50 per cent. or more of the fruit maturing later has been infested.

Schread (J. C.). **Behaviour of *Trichogramma* in Field Liberations.**—*J. Econ. Ent.*, xxv, no. 2, pp. 370–374, 1 fig. Geneva, N.Y., April 1932.

In the course of a season's laboratory and field experiments in the mass production and liberation of *Trichogramma minutum*, Riley, in Connecticut, it was concluded that the higher percentage of parasitised eggs of the peach moth [*Cydia molesta*, Busck] generally observed at the beginning of the season in the first two rows of trees bordering woodland, pastures, etc., was partly due to the migration of *Trichogramma* into the orchard from outside areas where it had survived on native host eggs. On this basis, observations were made under laboratory and field conditions on the dispersal of *Trichogramma* from the standpoint of flight. When liberated in a block of 121 peach trees 18 ft. apart without parasites, *T. minutum* dispersed in all directions and effected 50 per cent. parasitism. Low parasitism in another orchard was increased 53 per cent. after a single liberation. In a third orchard having a natural high parasitism, the percentage was not increased by large liberations. Under laboratory conditions *T. minutum* was found to be able to fly 24 feet. The results obtained indicate that spread is due to a combination of flight and air currents, the former factor slightly preponderating.

Allen (H. W.) & Warren (A. J.). **The Results from two Years' Experiments in Mass Liberations of *Trichogramma minutum* against the Oriental Fruit Moth.**—*J. Econ. Ent.*, xxv, no. 2, pp. 374–380, 1 map, 1 ref. Geneva, N.Y., April 1932.

The following is mainly taken from the authors' summary and conclusions : In the course of work carried out in New Jersey in 1930 and 1931 to determine whether mass liberations of *Trichogramma minutum*, Riley, would appreciably reduce infestation by the oriental fruit moth [*Cydia molesta*, Busck], 16 experimental liberations were made in blocks of late peaches. Reductions of fruit infestations during both seasons were, however, of insignificant economic importance. The results so far secured indicate that a slight reduction of fruit infestation usually follows the mass liberation of *T. minutum* in such a manner as to distribute approximately 400 adults in each tree about 24 days before fruit picking. Under methods of production and handling now in use the cost of obtaining and placing the parasites in orchards in properly protected containers, one to each tree, would be about 9*d*. a tree. The average results obtained in the experiments would not justify the expense of rearing and liberating the parasites, but it is possible that

by changing the methods used more favourable results might be secured. It is, however, believed inadvisable to embark on large scale control operations with *T. minutum* until it has been shown by properly controlled experiments in the section concerned not only that mass liberations actually result in increased parasitism above the normal for this species in untreated orchards, but that such liberations are actually followed by reductions in fruit infestation.

Frost (S. W.). **Preliminary Experiments with new Spray Materials against the Oriental Fruit Moth.**—*J. Econ. Ent.*, xxv, no. 2, pp. 381–385, 1 pl. Geneva, N.Y., April 1932.

Sodium aluminium fluoride [cryolite] and 1 per cent. oil emulsions were used in tests conducted in Pennsylvania to discover a spray material toxic to the larvae of *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental fruit moth). Individual fruits were sprayed from four angles with an atomiser. They were then hung on racks by means of wires and the spray allowed to dry before the eggs were placed near them. Microscope slides were wired to the fruit to take the place of foliage, and the eggs were attached to the bottoms of the slides. The fruits were left for three weeks and then cut to determine the percentage infested. The results obtained show that a 1 per cent. oil emulsion kills a high percentage of the newly hatched larvae of *C. molesta*, which are apparently repelled and fall off without gaining entrance to the fruit. A better kill could be expected under orchard conditions, when some of the eggs would be hit by the spray. Although much scorching was experienced with 1 per cent. summer oils, some of them produced no apparent injury, and it appears possible to find an oil that can be used with safety on peaches during the growing season. Difficulties may, however, arise in connection with the removal of residues and discolouration of the fruit. Sodium aluminium fluoride at the rate of 3 lb. to 100 U.S. gals. of water caused considerable scorching and did not give a high percentage of control.

Driggers (B. F.) & Pepper (B. B.). **Effect of artificial Illumination on the Oriental Fruit Moth under Orchard Conditions.**—*J. Econ. Ent.*, xxv, no. 2, pp. 385–392, 1 pl., 5 refs. Geneva, N.Y., April 1932.

The following is the authors' abstract: A study of the effect of light from ordinary electric light bulbs on egg deposition by the oriental fruit moth [*Cydia molesta*, Busck] was made on several varieties of peaches in New Jersey. The lights were suspended above the trees in such a way that groups of trees received different degrees of illumination ranging from 0 to 10 or more foot-candles. One tree in each of these tests was illuminated from above and below so that all parts of the tree received illumination of an intensity of 10 foot-candles or more. The lights were burned nightly or at such times as the moths showed activity. A photo-electric relay and thermostat was used to switch the lights off and on at the desired light intensity and temperature in the orchard. The effect of the lights on egg deposition was measured by counting the number of injured twigs caused by first and second brood larvae and by the percentage of injured fruit at harvest. No repellency to the moths was noted in any of the tests, nor was any pronounced attraction of the moths by the light evident.

Burgess (A. F.). **The present Status and future Requirements of the Gipsy Moth Problem.**—*J. Econ. Ent.*, xxv, no. 2, pp. 393–396. Geneva, N.Y., April 1932.

Preventive work carried out against the gipsy moth [*Porthetria dispar*, L.] in New Jersey in 1931 is briefly described. No treatment has been required as this moth has not been found in the State since the spring of 1929 [*R.A.E.*, A, xviii, 681]. The quarantine and inspection work carried out in the New England States has been very effective in preventing the spread of the moth to widely scattered points throughout the United States, where products that might carry infestation are constantly being shipped. Effective work has also been done in exterminating colonies found in the barrier zone. Numerous infestations were found during the winter of 1930–31 in south-western Massachusetts, north-western Connecticut and an extension of this area into New York State [*cf.* xviii, 682]. Whereas excellent results have been secured in the barrier zone area, very thorough and intensive work will be required in order permanently to limit the spread of *P. dispar* and maintain the advantage that has been secured by the previous work conducted in this zone.

Fox (H.). **The Distribution of the Japanese Beetle in 1930 and 1931, with special Reference to the Area of continuous Infestation.**—*J. Econ. Ent.*, xxv, no. 2, pp. 396–407, 2 maps, 2 refs. Geneva, N.Y., April 1932.

The following is the author's abstract: The apparent total range of *Popillia japonica*, Newm. (Japanese beetle) in the United States is divisible into an area of continuous and one of discontinuous distribution. The former is alone considered. Maps are given showing the area of continuous distribution in 1930 and in 1931 and indicating the varying degrees of infestation within its limits. The size of the area is given, and it is pointed out that its expansion has not progressed uniformly in all directions. Heavy infestation is typical of open country and is of only local occurrence, that in thinly settled and heavily wooded country being relatively light. Areas of unusually intense or maximum infestation no longer coincide with the original centre of the range, but each year shift their position further out into later infested sections. The limits of the general area of continuous distribution are approximately defined by citation of localities.

Hallock (H. C.). **Traps for the Asiatic Garden Beetle.**—*J. Econ. Ent.*, xxv, no. 2, pp. 407–411, 1 pl., 2 refs. Geneva, N.Y., April 1932.

The geraniol trap [*R.A.E.*, A, xviii, 644, etc.] has proved of practically no value for catching adults of *Aserica* (*Autoserica*) *castanea*, Arrow (Asiatic garden beetle). The history of the evolution of the light traps is given from the first one, which caught 217 beetles, to one that caught 21,000 beetles in a single favourable night. The latter consists of an electric bulb suspended 6 ft. from the ground and 5 ins. above a funnel 4 ft. in diameter at the top, through which the beetles fall into a container. Factors affecting the efficiency of light traps are discussed. It has been determined that a 500-watt daylight bulb attracts more beetles than either clear or frosted bulbs of the same power. The light of the trap should not be allowed to shine brightly on objects near

the trap, as many beetles will congregate on them instead of flying into the trap. It is possible that the efficiency of the funnel trap may be improved by placing a sufficiently large pan beneath the funnel to catch beetles striking its outside and by painting the entire funnel with white enamel. Temperature is the most outstanding factor in connection with the flight of the beetles [xviii, 413].

JONES (W. W.). *Harmolita* **species in Rye Grass.**—*J. Econ. Ent.*, xxv, no. 2, p. 412. Geneva, N.Y., April 1932.

Galls found on unheaded stems of *Elymus* on the coast of California, where this grass has been observed to produce few if any heads, after being placed in a breeding jar in the winter of 1928 yielded in the following spring *Harmolita elymophaga*, Phillips, *Eurytoma pachyneuron*, Gir., and *Eupelmus allyni*, French.

LIST (G. M.). *Eucosma argentialbana* **Wlsm., as a Pest on Chrysanthemums.**—*J. Econ. Ent.*, xxv, no. 2, p. 412. Geneva, N.Y., April 1932.

A heavy infestation of chrysanthemums investigated in Colorado in June 1931 was found to be due to *Eucosma argentialbana*, Wlsm. The larvae were apparently chiefly feeding upon the live tissues of the roots, but in some cases dead tissue seemed to be affording them equally good nourishment. The moths emerged during the latter part of June and early July. No previous record of the food-plants of this Tortricid appears to exist.

RICHARDSON (H. H.). **Control of the Red Spider Mite and Citrus Mealybug on Greenhouse Plants.**—*J. Econ. Ent.*, xxv, no. 2, p. 412. Geneva, N.Y., April 1932.

As much as 95 per cent. control of *Tetranychus telarius*, L., was obtained with one application of a 6·5 per cent. dilution (1 : 16) of a commercial material containing 11·7 per cent. potassium soap, 2·1 per cent. potassium carbonate, 7 per cent. terpenes and 79·2 per cent. water. One application at the same dilution against *Pseudococcus citri*, Risso, killed 60 per cent. of the adults and 95 per cent. of the immature forms, as well as a considerable proportion of the eggs. Two applications at an interval of a week produced no apparent injury on the majority of the plants tested. Snapdragons [*Antirrhinum*] were very slightly injured, and geranium and maidenhair fern were definitely injured but recovered.

MCALISTER (L. C.). **An Observation of a Maggot,** *Rhagoletis pomonella* **Walsh, passing from one Blueberry into an adjacent Blueberry.**—*J. Econ. Ent.*, xxv, no. 2, pp. 412–413. Geneva, N.Y., April 1932.

Examination in August 1930 of two blueberries in contact, one apparently normal and the other showing typical signs of infestation by *Rhagoletis pomonella*, Walsh, showed that after consuming the contents of one berry the larva was in the course of eating its way into the other.

Chamberlin (F. S.). **The apparent Incompatibility of Barium Fluosilicate and Nicotine Sulphate.**—*J. Econ. Ent.*, xxv, no. 2, p. 413. Geneva, N.Y., April 1932.

A spray of 1½ lb. barium fluosilicate, 12 oz. nicotine sulphate and 50 U.S. gals. water applied at the rate of 100 U.S. gals. to the acre to shade grown tobacco in Florida infested simultaneously with *Franklinella fusca*, Hinds, *Epitrix parvula*, F., and *E. cucumeris*, Harr., caused severe scorching of the buds and leaves two days after the application, which did not, however, increase appreciably later. Nicotine sulphate alone was simultaneously used over a large area of tobacco without any apparent scorching, and barium fluosilicate was being applied in other fields at the rate of 4–6 lb. to the acre with only a slight trace of foliage injury.

Ditman (L. P.). **An Observation on the Hibernation of the Corn Earworm in Maryland.**—*J. Econ. Ent.*, xxv, no. 2, p. 413. Geneva, N.Y., April 1932.

In order to determine the extent to which the pupae of *Heliothis* (*Chloridea*) *obsoleta*, F., had survived the winter in the soil following a severe infestation of maize, tomatos and beans in Maryland in 1930, soil samples consisting of one square yard of soil 10–12 inches deep were taken on 21st March 1931 from several different parts of two representative fields, one of tomatos and one of beans, neither of which had been disturbed since the crop was harvested. In the bean field live pupae were found at the rate of 13,500 and dead pupae at the rate of 10,500 to the acre, and in the tomato field they were about one-third as numerous. Over 90 per cent. of the adults emerging from the living pupae taken proved to be *H. obsoleta*.

Dozier (H. L.). **Introduction of *Eretmocerus serius* Silv. into Haiti.**—*J. Econ. Ent.*, xxv, no. 2, p. 414. Geneva, N.Y., April 1932.

Following unsuccessful attempts to find a native parasite of *Aleurocanthus woglumi*, Ashby, in Haiti, a supply of *Eretmocerus serius*, Silv., was obtained from Cuba, where it had been introduced in 1930 [*R.A.E.*, A, xix, 570] and is now thoroughly established. A recent report from Cuba shows that 30 groves, previously heavily infested, are now commercially clean, examination of controlled infestations showing approximately 80 per cent. parasitism.

Liberations have been made in Haiti from two separate shipments of *Citrus* leaves received by aeroplane from Havana at the end of July and in the middle of August, 1931. The first shipment yielded about 150 adults, which were released on properties well infested with *A. woglumi* on *Citrus* and coffee. The majority were released directly on infested foliage, but others were placed in cellophane bags on vertical branches heavily infested with the younger stages. The second shipment consisted of about 550 adults. The parasites were observed to start ovipositing immediately on several different stages of the Aleurodid, and it is hoped that the introduction will prove as successful in Haiti as in Cuba.

Richardson (H. H.). **Pyrethrin Sprays in the Control of Greenhouse Pests.**—*J. Econ. Ent.*, xxv, no. 2, p. 415. Geneva, N.Y., April 1932.

Tests with sprays containing known concentrations of pyrethrins in combination with potassium oleate soap (0·25 per cent.) indicated that such sprays, even with concentrations of pyrethrins as strong as 1 : 5,000, killed only the immature stages of *Pseudococcus citri*, Risso, on *Coleus*. Concentrations as high as 1 : 1,000 were required to give commercial control (94 per cent.) of *Tetranychus telarius*, L. Against *Hercothrips* (*Heliothrips*) *femoralis*, Reut., a concentration of between 1 : 5,000 and 1 : 10,000 was necessary. Concentrations required to control Aphids varied with the different species, 1 : 10,000 giving complete control of *Macrosiphum sanborni*, Gill., and *Aphis rumicis*, L., and about 60–70 per cent. control of *Myzus persicae*, Sulz. Nearly 100 per cent. mortality of woodlice was secured with a concentration of about 1 : 2,000.

Snapp (O. I.) & Thomson (J. R.). **A second Report on burying Peach Drops to prevent the Escape of Plum Curculio Adults.**—*J. Econ. Ent.*, xxv, no. 2, pp. 415–416. Geneva, N.Y., April 1932.

Continued experiments to determine the effectiveness of burying peaches infested by *Conotrachelus nenuphar*, Hbst. [*R.A.E.*, A, xix, 492], in which dropped fruit was covered with soil to depths varying from 18 to 36 inches, and adult emergence was observed daily from the first appearance on 15th June until 37 days after the last emergence, show that this method of disposal is definitely unsafe. Infested peaches should be burnt or boiled, or bags of them submerged in large bodies of water.

Salt (R. W.) & Hinman (E. H.). **Bound Water.**—*J. Econ. Ent.*, xxv, no. 2, pp. 416–417. Geneva, N.Y., April 1932.

The authors point out certain errors in examples given by Bodenheimer & Schmidt in a paper previously noticed [*R.A.E.*, A, xx, 36] of the procedure in using Robinson's method for the determination of bound and free water in the insect body.

Doucette (C. F.) & Baker (W. W.). **Indications of a Control Measure for *Tarsonemus pallidus* Banks on Strawberry.**—*J. Econ. Ent.*, xxv, no. 2, pp. 417–418. Geneva, N.Y., April 1932.

Bundles of 50 strawberry runner plants infested by *Tarsonemus pallidus*, Banks, were exposed to a temperature of 110°F. in a saturated atmosphere, the treatment being continued for periods of $1\frac{1}{2}$ and 3 hours after a thermometer placed in the centre of the bundle reached 110°F., or two hours after actual exposure started. The plants were dug in the morning of 29th October 1930 and treated the same afternoon, one bundle representing each treatment being planted the following day. Examination at planting time failed to reveal the presence of any live mites on either of the treated lots, and further inspection at frequent intervals has not shown any mites or eggs in leaf buds, leaves, blossoms or fruit. All stages of the mites were found on untreated plants similarly planted for comparison. Many of the roots of plants from both treatments were found to be killed or badly injured when

examined on 14th January 1931, but no plants were killed outright. Although in April when the untreated plants were producing numerous blooms, only five plants in each of the treated groups showed flowers, by July both of the treated groups were blooming profusely and showed excellent leaf growth. After this, fruit production was continuous and heavy on the treated plants, whereas mite infestation on the untreated ones kept them stunted, prevented them from producing runners, and rendered the fruit inferior and misshapen.

Felt (E. P.). **A new Pest in Greenhouse grown Grape Stems.**—*J. Econ. Ent.*, xxv, no. 2, p. 418. Geneva, N.Y., April 1932.

Stems of vines from Long Island, New York, showing typical galleries of ambrosia beetles, were found to be attacked by *Xyleborus germanus*, Bldf., a Scolytid hitherto only recorded in Japan, Korea and Formosa, and known to attack only *Benzoin thunbergi*, *Carpinus laxiflora* and *Styrax japonicum*. It is probable that *X. germanus* occurs in other woody greenhouse plants in the United States, as a number of related species are known to breed in a variety of plants. Weak plants are the most susceptible to attack by this beetle, the economic status of which cannot at present be determined.

Parker (J. R.), Walton (W. R.) & Shotwell (R. L.). **How to Control Grasshoppers in Cereal and Forage Crops.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 1691, 13 pp., 11 figs. Washington, D.C., April 1932.

This bulletin is a revision of and supersedes one already noticed [*R.A.E.*, A, v, 241], the grasshoppers dealt with being *Brachystola magna*, Gir., *Melanoplus differentialis*, Thos., *M. bivittatus*, Say, *M. mexicanus*, Sauss., *M. femur-rubrum*, DeG., *Dissosteira carolina*, L., and *Camnula pellucida*, Scudd. To destroy the eggs, infested soil should be ploughed to a depth of at least 6 inches and then packed or disked several times about every 10 days in warm, dry weather during September and October. Various poisoned bran baits are recommended [*cf.* xx, 410–412]. If possible they should be applied against newly hatched hoppers while they are still congregated on their hatching grounds or before they have invaded the crops. Very brief notes are given on additional control measures, and a plan for the organisation of co-operative efforts is suggested.

Fluke (C. L.), Graber (L. F.) & Koch (K.). **Populations of White Grubs in Pastures with relation to the Environment.**—*Ecology*, xiii, no. 1, pp. 43–50, 5 figs., 5 refs. Brooklyn, N.Y., January 1932.

The following is taken from the authors' summary of observations in Wisconsin in connection with the infestation of bluegrass pastures (*Poa*) by *Lachnosterna* (*Phyllophaga*) spp. [*cf. R.A.E.*, A, xix, 477, 487]. Population counts of white grubs in permanent bluegrass pastures reveal that thick or very dense turf resulting from judicious grazing practices, ample fertility, and favourable moisture conditions is relatively free from infestation. Either the beetles have selective egg-laying habits, choosing the thinner turf, where the grass is weakened by an unfavourable environment, or with indiscriminate laying the

eggs may fail to hatch or produce larvae capable of penetrating thick dense turf.

The larvae are much less numerous in thick stands of sweet clover (*Melilotus*) established in permanent bluegrass pastures than in adjoining pastures of bluegrass alone. Such differences in grub densities are accounted for by adult avoidance of sweet clover for oviposition, since it is assumed that if the eggs were laid in such places they would hatch and the larvae develop.

SEVERIN (H. H. P.). **Modes of Curly-top Transmission by the Beet Leafhopper, *Eutettix tenellus* (Baker).**—*Hilgardia*, vi, no. 8, pp. 253–276, 6 figs., 14 refs. Berkeley, Cal., November 1931. [Recd. May 1932.]

A detailed account is given of experiments carried out in connection with the incubation period of the virus of curly-top disease of sugar-beet in *Eutettix tenella*, Baker, and the problem of the transmission of the disease in very short periods. Batches of 40 previously non-infective leafhoppers transferred from diseased to healthy plants produced percentages of transmission varying from 2·4 in 20 minutes total feeding to 33·3 in 4 hours. When single previously non-infective leafhoppers were fed on diseased and healthy plants for varying periods, the shortest time in which transmission was obtained was 7 hours. Infection was produced more often when the number of insects, and consequently the amount of virus injected, were increased. The percentage of the disease transmitted by single leafhoppers with virus incubation periods of 1–7 days varied from 13·3 to 40, the lowest percentage occurring at the end of 1 day. Previously non-infective nymphs fed on a culture of the mouth-parts of leafhoppers that had fed on diseased plants for ½–1 hour, transmitted the disease, thus demonstrating contamination of the mouth-parts, but nymphs fed on culture media containing the excreta or on filtrate prepared from the faeces failed to transmit curly-top to healthy beets.

MCATEE (W. L.). **Effectiveness in Nature of the so-called protective Adaptations in the Animal Kingdom, chiefly as illustrated by the Food Habits of Nearctic Birds.**—*Smithson. Misc. Coll.*, lxxxv, no. 7 (Pubn. 3125), 201 pp., 57 pp. refs. Washington [D.C.], 15th March 1932.

This paper is based largely on records of animals identified in the stomach contents of some 80,000 nearctic birds examined in the United States Biological Survey since 1885. It is found that 88 per cent. of these records consist of Arthropods, of which more than 90 per cent. are insects. The latter are discussed in 74 pages under general groups, with notes on their other natural enemies and protective adaptations. The author considers the importance of the latter to have been overestimated.

CANADA. **Destructive Insect and Pest Act. Regulation No. 19 (Foreign).**—*A.O.R.*, no. 8, Suppl. 1 p. Ottawa, 29th March 1932.

In order to prevent the introduction of *Taeniothrips gladioli*, Moult & Stein, into British Columbia, where it is not known to occur, the importation from the United States of *Gladiolus*, including all parts of the plant, into that Province is prohibited.

Balfour-Browne (F.). **A Text-book of practical Entomology.**—Cr. 4to, viii+191 pp., 116 figs. London, E. Arnold & Co., 1932. Price 18*s*.

This book is divided into three main parts, arranged so as to provide the basis for three graduated courses on entomology. It deals chiefly with the morphology of insects, with the addition of many details of the best technique for the study of this subject. The last part contains an important section on the external morphology of insect types. The work is illustrated with a large number of original drawings, and it should prove equally valuable to the teacher and the student.

Davidson (J.). **Some Factors affecting Oviposition of *Sminthurus viridis* L. (Collembola).**—*Aust. J. Exp. Biol. Med. Sci.*, x, pt. 1, pp. 1–16, 2 figs., 3 refs. Adelaide, 16th March 1932.

An account is given of further experiments on *Smynthurus viridis*, L., in South Australia [*R.A.E.*, A, xix, 600 ; *cf.* also xx, 400], this paper dealing with the influence of various factors on oviposition. The eggs are laid on the soil in batches containing an average of 40–60 under favourable conditions, though the numbers are subject to considerable variation. The number laid is increasingly high when the moisture content of the soil is above about 12 per cent. (50 per cent. saturation), though on saturated soil there is a reduction and many batches are badly formed ; on a soil having a moisture content below about 10 per cent. a marked decrease also occurs, and on an air-dry soil no eggs are laid. A soil having a low moisture content at the beginning of a dry period will become unfavourable for oviposition more rapidly than one having a high water-holding capacity.

The temperature of moist soil may be an important factor affecting the economic distribution of the species, in regions having a summer rainfall and high temperatures. At a temperature of about 26°C. [78·8°F.] on the surface of moist soil, fewer eggs are laid than at 15°C. [59°F.]. Further investigations are necessary regarding the reaction of the insect to changes in the micro-environment on the surface of the soil, particularly to those in the relative humidity of the air.

When a uniform soil moisture is maintained, there is a decrease in the number of egg batches as the soil becomes more alkaline.

Moisture of the soil is the most important factor affecting the economic distribution of *S. viridis* in South Australia. With soils having a pH value of 5·4–7·5, the reaction of the soil in itself does not appear to be of practical importance in relation to infestation.

Risbec (E.). **Rapport à Monsieur le Gouverneur rendant compte de la tournée effectuée du 6 au 19 Octobre et du 27 Octobre au 13 Novembre.**—*Rev. agric. Nouv.-Calédonie*, 1932, pp. 679–685. Noumea, March 1932.

The insect pests recorded on tobacco in New Caledonia are *Prodenia litura*, F., *Heliothis obsoleta*, F., and *Phthorimaea operculella*, Zell. Brief descriptions of the insects and their habits are given, with suggestions for remedial measures taken from the literature.

Meyrick (E.). **Exotic Microlepidoptera, iv, pt. 8.**—pp. 225–256. Marlborough, Wilts, the author, June 1932. Price 3*s.* per part

Among the new species described, the Tineid, *Decadarchis carpophthora*, is recorded as bred from larvae feeding inside very young coconuts in the Solomon Islands. The author now considers that the Tortricids, *Homona menciana*, Wlk., and *H. socialis*, Meyr., are geographical forms of *H. coffearia*, Nietn.

Hart (P. C.). **Proeven omtrent topboorderbestrijding in aanplant 1930–'31.** [Experiments in the Control of the Tip-borer in 1930–31 Sugar-cane.]—*Arch. Suikerind. Ned.-Ind.*, iii, pp. 527–587. Also as *Meded. Proefst. Java-Suikerind.*, no. 8. Surabaya, 1932.

Experiments on the control of the white tip-borer of sugar-cane [*Scirpophaga intacta*, Sn.] in Java [*R.A.E.*, A, xviii, 194; xix, 337] were continued in 1930–31 and are here described in detail for the various areas. The work reduced infestation and loss by from 75 to 50 per cent. of the normal. Control is advisable where the normal injury is ascertained to be 8–10 per cent.

Misaka (K.). **Ueber die Wirkung des Nikotinsulfates auf die Embryonalentwicklung von *Chilo simplex* Butler.** [On the Effect of Nicotine Sulphate on the embryonal Development of *C. simplex*.]—*Bull. Imp. Agric. Exp. Sta.*, iii, no. 3, pp. 225–242, 14 figs., 1 pl., 29 refs. Tokyo, March 1932.

In laboratory experiments eggs of *Chilo simplex*, Butl., in all stages of development were brushed with nicotine sulphate solutions of known strengths. A concentration equivalent to 0·03 per cent. pure nicotine destroyed all eggs, whereas more dilute solutions killed the older ones only, the younger being merely retarded in development. It was found that the toxic action occurs when the fully developed nerves and tracheae begin to function, death being due to nicotine vapour inhaled through the egg-shell. In another set of experiments, eggs were placed in bottles in which pure nicotine was evaporated. A dose of 0·2836 mgm. per litre killed all eggs except those less than 24 hours old. With smaller doses, all eggs survived.

Sonan (J.). **Notes on some Braconidae and Ichneumonidae from Formosa, with Descriptions of 18 new Species.**—*Trans. Nat. Hist. Soc. Formosa*, xxii, no. 118–119, pp. 66–87. Taihoku, Formosa, April 1932.

New species described from Formosa include the Braconids, *Opius arisanus* and *O. makii*, both reared from pupae of *Dacus dorsalis*, Hend.; *Chelonus formosanus*, which oviposits in egg masses of *Cirphis loreyi*, Dup., and *Prodenia litura*, F., the larvae attacking the host larvae; and *Chelonella nitobei* reared from larvae of *Eucosma schistaceana*, Sn.

[Tupikov (V. K.).] **Тупиков (В.К.). Oekologische Charakteristik des Phylloxerenheerdes in Tuapse.** [Ecological Characteristics of the Habitat of *Phylloxera* in Tuapse.] [*In Russian.*]—*Bull. Plant Prot.* (1 Ent.), no. 4, pp. 45–70, 11 figs. Leningrad, 1932. (With a Summary in German.)

An account is given of investigations on *Phylloxera* carried out in 1927–30 in a vineyard of over 16 acres near the town of Tuapse

(Transcaucasia), where root and leaf forms both occur on European and American vines, the leaf form having been first observed in 1925. The topography of the vineyard and climatic and soil conditions are discussed. Infestation occurs chiefly through the roots, which intertwine in the soil, thus facilitating the gradual migration of the larvae ; in plots cultivated on steep hills it spreads rapidly down hill and only very slowly upwards. The migration of the larvae is hindered by the hard, compact soil of paths that separate individual plots. Infestation is more severe and spreads more rapidly in plots where the level of the subsoil water remains low during the winter [see next paper]. The Aphids may occasionally be carried on tools or the clothes of workmen, and wind may distribute the leaf gall larvae from American to European vines. The reactivation of larvae hibernating on the roots begins in April ; in 1928 the first active larvae were found on 6th April at a depth of 6 ins. where the soil temperature at 1 p.m. was 14·6°C. [about 58°F.], whereas in 1929 they were not observed before 25th April. The reactivation period is very protracted and sometimes lasts till mid-May. Of the radicicolae only the first instar larvae overwinter, exclusively on woody roots, in cracks and under the loose old bark. Reproduction usually begins in the first half of May. Nymphs, which are much more numerous on American than European vines, occur for about 40–55 days from the end of July till the temperature drops to 10°C. [50°F.]. The radicicolae begin to enter hibernation when the temperature of the soil falls to 10°C., and all have done so by the end of November or beginning of December, the soil temperature then being 7°C. [44·6°F.]. Examination of infested roots showed that most of the Aphids occur at a depth of from 4 to 10 ins. ; the average number per sq. cm. of root surface is only 0·02–0·7 in winter and early spring, but it increases with the beginning of the reproductive period, the maximum being reached in August–September.

The effect of infestation on different varieties of vines is discussed.

[Vodinskaya (K. I.).] **Водинская (К.И.). Beiträge zur Biologie der Reblaus in Tuapse.** [Contribution to the Biology of *Phylloxera* in Tuapse.] [*In Russian.*]—*Bull. Plant. Prot.* (1 Ent.), no. 4, pp. 71–96, 6 diag. Leningrad, 1932. (With a Summary in German).

The bionomics of the root form of *Phylloxera* as observed near Tuapse in 1927–1930 are discussed in detail, some of the information being similar to that in the preceding paper. The number of generations, which overlap, varies in different years from six to eight, or possibly nine, depending on the temperature. In 1928 all the stages of three generations were present on the vine roots in August-September. The depth at which the larvae are found in the ground in the spring varies from 32 to 14 ins., depending on the level to which the subsoil water rises and destroys those present in the deeper layers in winter. Reactivation takes place when the temperature of the soil is above 13°C. [55·4°F.], and migration starts immediately after the appearance of the young larvae of the first generation, usually at the end of May. The larvae usually wander along the roots, and laboratory investigations showed that about 88 per cent. of those that migrated along cracks in the soil did not survive. The duration of the feeding period varies with the temperature from 21 to 12 days. Observations on oviposition indicated that females developed from larvae that had fed in the spring

produce more eggs than those of the summer generations. Examination of an infested root also showed that the maximum oviposition occurred in June–July, when the root produced the largest number of tuberosities that were readily attacked by the young larvae, and decreased in August, when the tuberosities began to wither. The number of eggs laid by different females of the same generation in a given time varies greatly, the maximum being 150–200 in about two weeks. An attempt is made to divide the females into groups according to the rate at which they oviposit, and experiments on the effect of temperature on oviposition and egg development are discussed in detail. Excessive moisture in conjunction with low temperature kills the eggs, whereas in the summer they hatch even if submerged in water. The optimum temperature for their development is 30–32°C. [86–89·6°F.], at which they hatch in about 4 days, and that for the larvae 24–25°C. [75·2–77°F.]. Below 7°C. [44·6°F.] all stages except the hibernating first-instar larvae disappear. Of the latter over 75 per cent. die within the first two months of hibernation, the number per sq. cm. of root in spring being 0·02–0·6 as compared with 2·1–3·7 in the preceding November.

[Vodinskaya (K. I.).] **Водинская (К.И.). Die Gallenreblaus in Tuapse.** [Gall *Phylloxera* in Tuapse.] [*In Russian.*]—*Bull. Plant. Prot.* (1 Ent.), no. 4, pp. 97–118, 4 figs. Leningrad, 1932. (With a Summary in German.)

Observations on the leaf form of *Phylloxera* near Tuapse, carried out in 1927–1930 on American vines (Rupestris du Lot), showed that the appearance of the fundatrices depends on the temperature in the spring and coincides with the development of the first two or three leaves. There are about 8 generations a year. The fundatrices and their progeny usually infest the leaves of the main branches as they develop, but in later generations, when the Aphids become crowded, many of the larvae migrate to other branches and to the roots.

In 1928 only 4 per cent. of the vines were infested with fundatrices, a leaf usually bearing a single gall. As the larvae of the first two generations do not migrate to neighbouring vines, the percentage of plants infested at first remained unchanged, but at the end of May the average number of galls to a leaf had increased to 32. At the beginning of July 10·6 per cent. of the vines were infested, as many as 262 galls being found on a leaf; and after the appearance of the larvae of the fourth generation about mid-August the percentage of infestation and average number of galls to a leaf increased to 48·7 and 519. The wandering larvae of this and the fifth generations increased the infestation to 79·4 per cent. towards mid-September. At the end of the vegetative period the infested leaves were rolled, and those on the upper part of the stem withered.

The number of eggs produced by a female depends on the age of the leaf on which it feeds, being much higher in the first half of the season. Hair roots, which appear early in the spring, become infested as soon as the first generation of radicicolae hatch. In 1928 no neogallicolae-radicicolae occurred in the first generation; the second produced 14–18 per cent., the third 25–50 per cent., and the fourth 100 per cent. It was also found that neogallicolae-radicicolae may hatch from the first as well as the last eggs laid by individual females. Laboratory experiments showed that the time of appearance of nymphs on the roots

depends on when the neogallicolae-radicicolae enter the soil; those of the early generations (June–July) give rise to nymphs in the course of the same season, whereas those of the late generations do not. The nymphs become winged sexuparae 7–9 days after the second moult, and oviposit in 5–8 days, laying about 5 eggs each, which hatch in 10 days. In the field sexuparae were fairly abundant on American vines, whereas on European stocks their number was negligible.

Some of the leaf galls of *Phylloxera* are destroyed by *Eriophyes* (*Phytoptus*) *vitis*, Pgst., while it is feeding on the young leaves. In 1929 about 85 per cent. of the gallicolae were killed by *Thrips* sp., which sucked out the eggs and larvae, and the adults of the Tettigoniid, *Phaneroptera falcata*, Scop., which appeared in July and fed on the contents of the galls, though the larvae had only attacked the leaves.

Details are given of experiments with the artificial infestation of different varieties of American vines and hybrids with the leaf and root forms of *Phylloxera*. All the varieties proved susceptible to infestation by the leaf form during the period of leaf formation. If the infestation occurs when all the leaves have already developed, the number and quality of the galls vary on different varieties of vines. The larvae did not show any particular preference when roots of different varieties of hybrids were exposed to attack.

Infested branches should be pruned during the oviposition period of the first generation and before the larvae of the second hatch.

[Mogilyanskiĭ (N. K.).] **Могилянский (Н.К.). Einige Beiträge zur Wertung der Rebenpfropfung in dem System der Massnahmen gegen die Reblaus.** [Data towards the Valuation of the Cultivation of grafted Vines in Anti-phylloxera Measures. (Review of Literature). (*In Russian.*)]—*Bull. Plant. Prot.* (1 Ent.), no. 4, pp. 201–220, 2 graphs, 26 refs. Leningrad, 1932. (With a Summary in German.)

The value of the cultivation of vines grafted on American stocks in the Russian Union is discussed on the basis of foreign and Russian literature. It is concluded that though grafting is the only method that can ensure the cultivation of vines in districts where *Phylloxera* is widely distributed, for other reasons ungrafted vines are superior. They should therefore be preferred in the Russian Union, especially as *Phylloxera* is absent from a number of the vine-growing regions, and in others the infestation is only slight.

Legislation in Cyprus against Insect Pests and Fungus Diseases.—*Cyprus Agric. J.*, xxvii, pt. 1, pp. 5–16. Nicosia, March 1932.

This review of orders concerning insect pests, etc., in Cyprus brings up-to-date a summary already noticed [*R.A.E.*, A, xiv, 198]. The order requiring the destruction before 1st October of all almonds infested with *Eurytoma amygdali*, End., has been altered to make it apply to each tree separately. Owners of carob trees [*Ceratonia siliqua*] infested with *Asphondylia gennadii*, Marchal, are required to collect all infested pods before 20th April and burn them or bury them with quicklime under 1 ft. of soil. The whole Island was declared infested with *Dacus oleae*, Gmel., on 15th June 1928, and owners of

olive trees are required to collect daily all fallen olives from 1st September to 31st October, and to bury them in the ground or press them forthwith. Under an order dated 4th March 1930 all growers of potatoes attacked by *Phthorimaea operculella*, Zell., are required to burn them at once or bury them in lime, and it is prohibited to offer such potatoes for sale either for seed or any other purpose. Infested potatoes may not be moved out of the village where they are grown unless previously boiled. Rooms intended for storage of potatoes must be limewashed or fumigated before they are brought in. For the control of *Syringopais* (*Scythris*) *temperatella*, Led., in certain areas declared to be infested, the planting of wheat, barley, oats or rye is prohibited for from 2 to 4 years.

Goidanich (A.). **Un metodo di lotta efficace contro larve di alcuni Scarabeidi.** [An effective Measure against the Larvae of some Lamellicorns.]—*L'Italia agric.*, lxviii, no. 11, pp. 857–860, 5 figs. Piacenza, November 1931. [Recd. May 1932.]

In June 1929, the roots of two-year-old plums over an area of about 6 acres in the province of Rovigo were found to be infested by larvae of the Dynastid, *Pentodon punctatus*, Villers, and by early July about 400 plants had been killed. The losses were heaviest in plots where tobacco was associated with the plums. In the second half of July, however, effective control was obtained by fumigation with a commercial brand of paradichlorobenzene crystals, 12–20 gm. ($\frac{2}{5}$–$\frac{2}{3}$ oz.) being buried round each plant 4–6 inches deep at four points on a circle of 6–8 inches radius.

Pieri (A.) & Videsott (G.). **Contributo allo studio dei mezzi di lotta contro la *Carpocapsa pomonella*.** [A Contribution to the Study of Measures against *Cydia pomonella*.]—*Note Fruttic.*, ix, nos. 4–7, pp. 65–69, 81–85, 103–107, 121–127. Pistoia, April–July 1931. [Recd. May 1932.]

The experiments here described in detail were carried out in 1930 to test the value in Tuscany of lead arsenate sprays against *Cydia* (*Carpocapsa*) *pomonella*, L. The date of appearance of the moths of the overwintered generation was ascertained by means of bait-traps and cages in which cocoons were placed. Two rows of 10 trees, each row of a different variety, were selected in an apple orchard. The spray used contained 8 lb. copper sulphate, 8 lb. lime, and 5 lb. lead arsenate in 100 gals. water. A calyx spray was applied on 28th April to one variety, and on 5th May to the other. Four cover sprays followed. On 25th June 4·1 and 1·6 per cent. of the fruits from the treated trees were infested, according to the variety, the figures for untreated trees being 48·66 and 17·3. In July the flight of the new generation moths was ascertained as before, and sprays against the second generation larvae were applied on 29th July and 8th and 18th August. Only some of the trees of the two rows were treated, and of these some had only two applications. While spraying against the first generation was evidently beneficial, little advantage was gained by applications against the second; it is concluded that care in spraying is more important than the number of applications.

CARIMINI (M.). **Gli afidi delle piante da frutto e i mezzi per combatterli.** [Fruit Tree Aphids and the Means for combating them.]—*Note Fruttic.*, ix, no. 5, pp. 90–98, 10 figs. Pistoia, May 1931. [Recd. May 1932.]

A popular account is given of Aphids and their natural enemies. The species infesting fruit-trees in spring in Italy are *Hyalopterus arundinis*, F. (*pruni*, F.) on plum, peach, apricot and almond; *Myzus cerasi*, F., on cherry; *Anuraphis amygdali*, Buckt. (*persicae*, Boy.) on peach, which is also attacked by *A. persicae-niger*, Smith; and *Aphis pomi*, DeG. (*mali*, F.), which occurs on apple and pear without doing much harm. Sprays of quassia and soap or nicotine and soap are advised.

HERTZ (M.). **Uppträdende av *Lophyrus pini* i närheten av Käkisalmi.** [Appearance of *L. pini* in the Neighbourhood of Kexholm.]—*Notul. ent.*, xi, no. 3–4, pp. 152–156. Helsingfors, May 1932.

An account is given of the investigation of an outbreak of *Diprion* (*Lophyrus*) *pini*, L., that occurred in pine forests in Finland near Lake Ladoga in 1929. Out of a collection of 2,500 larvae in cocoons, taken in the infested area in the autmn of 1929 only 10 had developed to the adult stage by October 1930, and 8 per cent. seemed to have been parasitised. New collections of several hundred cocoons were made in June, July and September 1930. Of these 38 per cent. produced adults, and the larvae in 16 per cent. had either been parasitised or destroyed by birds or small rodents. The majority of the parasites were Ichneumonids, but a few Tachinids were present.

KANGAS (E.). **Om några skadeinsekter på tallplantor.** [Several Insect Pests on Pine.]—*Notul. ent.*, no. 3–4, pp. 156–160. Helsingfors, May 1932.

Brief notes are given on insects attacking growing pines in Finland, of which the most important are *Luperus pinicola*, Andersch, *Pissodes notatus*, F., *Rhyacionia* (*Evetria*) *resinella*, L., *R.* (*E.*) *turionana*, Hb., *Hylobius abietis*, L., *Myelophilus* (*Blastophagus*) spp., and *Diprion* (*Lophyrus*) *pallipes*, Fall.

HAHMANN (C.). **Abteilung für Pflanzenschutz.** [Plant Protection Division.]—*JBer. Inst. angew. Bot. Hamburg, 1931*, pp. 74–94. Hamburg, 1932.

An annotated list is given of the various plant diseases and insect pests noticed in and around the territory of Hamburg in 1931, as well as an account of tests with a number of proprietary insecticides. *Hylotrupes bajulus*, L., infesting the attics of a building, was successfully destroyed by heat produced by a generator commonly used for drying out newly erected buildings [*cf. R.A.E.*, A, xix, 379]. After one hour, an air-temperature of 80–87°C. [176–188·6°F.] was attained in the rooms. It then rose to 88–100°C. [190·4–212°F.], at which it was maintained for 7 hours. All beetles and larvae were killed inside the beams, in which temperatures of 63–74°C. [145·4–165·2°F.] were reached.

PAPERS NOTICED BY TITLE ONLY.

EIDMANN (H.). **Beiträge zur Kenntnis der Biologie, insbesondere des Nestbaues der Blattschneiderameise** *Atta sexdens* **L.** [Contribution to the Knowledge of the Biology, especially of the Nest Construction, of the Leaf-cutting Ant, *A. sexdens*.]—*Z. Morph. Oekol. Tiere*, xxv, no. 1, pp. 154–183, 9 figs., 18 refs. Berlin, 1932.

ATWOOD (C. E.). **Bees and Pollination of the Apple. A Review of the Literature.**—*22nd Ann. Rep. Quebec Soc. Prot. Plants 1929–30*, pp. 30–32, 27 refs. Quebec, 1931. [Recd. May 1932.]

WOODROW (A. W.). **The Comparative Value of different Colonies of Bees in Pollination.**—*J. Econ. Ent.*, xxv, no. 2, pp. 331–336, 1 ref. Geneva, N.Y., April 1932.

FILMER (R. S.). **Brood Area and Colony Size as Factors in Activity of Pollination Units.**—*J. Econ. Ent.*, xxv, no. 2, pp. 336–343, 4 refs Geneva, N.Y., April 1932.

BALDUF (W. V.). **Revision of the Chalcid Flies of the Tribe Decatomini (Eurytomidae) in America north of Mexico** [including the sole genus *Decatoma*].—*Proc. U. S. Nat. Mus.*, lxxix, art. 28, no. 2894, 95 pp., 4 pls., 11 refs. Washington, D.C., 1932.

BURGESS (E. D.). **A Comparison of the alimentary Canals of the active and hibernating Adults of the Mexican Bean Beetle,** *Epilachna corrupta* **Muls.**—*Ohio J. Sci.*, xxxii, no. 3, pp. 249–261, 2 pls., 2 figs., 12 refs. Columbus, Ohio, May 1932.

LUDWIG (D.). **Studies on the Metamorphosis of the Japanese Beetle (*Popillia japonica* Newman). i. Weight and Metabolism Changes.**—*J. Exp. Zool.*, lx, no. 3, pp. 309–323, 2 figs., 16 refs. Philadelphia, Pa., 5th October 1931.

MACALONEY (H. J.). **The White-pine Weevil** [*Pissodes strobi*, Peck].—*Circ. U. S. Dept. Agric.*, no. 221, 30 pp., 10 figs., 5 graphs, 20 refs. Washington, D.C., May 1932. [For fuller account see *R.A.E.*, A, xviii, 469.]

CRIDDLE (N.). **The Control of Grasshoppers in Canada East of the Rocky Mountains.**—*Pamph. Dept. Agric. Canada*, no. 146, 8 pp., 2 figs. Ottawa, March 1932. [For a fuller account see *R.A.E.*, A, xix, 473.]

CHIAROMONTE (A.). **Considérations entomologiques sur la culture du coton en Somalie Italienne.**—*Coton et Culture cotonnière*, v, fasc. 3, reprint 7 pp. Rouen [? 1932]. [Translation of *R.A.E.*, A, xix, 504].

[RUKAVISHNIKOV (B.).] **Рукавишников (Б.). An Experiment in the Control of Pests of Sugar-beet.** [*In Russian.*]—*Aviatz. Bor'be Vredit. sel'sk. i lesn. Khoz.* [*Aviation in Control of Agric. & Forest Pests.*] *Mater. 1st All-Union Avio-Chem. Conf. Moscow 1930*, pp. 88–109, 5 graphs, 5 refs. Moscow, Sel'kolkhozgiz [Agric. Co-op Pub.], 1932. [See *R.A.E.*, A, xx, 346.]

DIAMANDIDI (M.). **Диамандиди (M.). Die Biologie der Reblaus im Waldsteppengebiet Moldaviens.** [The Biology of *Phylloxera* on Vines in the Forest-Steppe Zone of Moldavia.] [*In Russian.*]—*Bull. Plant Prot.* (1 Ent.), no. 4, pp. 119–130, 9 refs. Leningrad, 1932. (With a Summary in German.) [See *R.A.E.*, A, xix, 464.]

TAKAHASHI (R.). **Additions to the Aphid Fauna of Formosa (Hemiptera).**—*Philippine J. Sci.*, xlviii, no. 1, pp. 69–75, 2 figs., 2 refs. Manila, May 1932.

TAKAHASHI (R.). **New Food-plants of the Coccidae in Formosa.**—*Trans. Nat. Hist. Soc. Formosa*, xxii, no. 118–119, pp. 102–105. Taihoku, Formosa, April 1932.

GOUX (L.). **Notes sur les Coccides (Hém.) de la France (4e note). Description de *Ceroccocus* nouveaux.**—*Bull. Soc. ent. Fr.*, xxxvii, no. 9, pp. 140–144, 24 figs. Paris, 1932.

LINDINGER (L.). **Die Synonymie von Walkers Cocciden (Hem.).**—*Mitt. deuts. ent. Ges.*, iii, no. 2, pp. 26–27. Berlin, February 1932.

MAHDIHASSAN (S.). **Das zweite Larvenstadium der weiblichen Lackschildlaus.** [The second larval Stage of the Female Lac Insect.]—*Zool. Anz.*, xciv, no. 11–12, pp. 289–304, 16 figs., 18 refs. Leipzig, 1931.

LINFORD (M. B.). **Transmission of the Pineapple Yellow-spot Virus by *Thrips tabaci* [in Hawaii].**—*Phytopathology*, xxii, no. 4, pp. 301–324, 8 figs., 8 refs. Lancaster, Pa., April 1932. [*Cf. R.A.E.*, A, xix, 744.]

MORSTATT (H.). **Bibliographie der Pflanzenschutzliteratur. Das Jahr 1931.** [A Bibliography of Plant Protection Literature in 1931.]—Imp. 8vo, iv+251 pp. Berlin, P. Parey; J. Springer, 1932. [*Cf. R.A.E.*, A, xix, 560.]

IMMS (A. D.). **Temperature and Humidity in Relation to Problems of Insect Control.**—*Ann. Appl. Biol.*, xix, no. 2, pp. 125–143, 2 diag., 30 refs. Cambridge, May 1932.

BRINDLEY (T. A.) & RICHARDSON (C. H.). **Constant Temperature and Humidity Apparatus for Use in the experimental Study of Insects.**—*Iowa St. Coll. J. Sci.*, v, no. 4, pp. 211–222, 3 pls., 2 refs. Ames, Iowa, 1931. [Recd. May 1932.]

PETCH (T.). **British entomogenous Fungi.**—*Naturalist*, no. 903, pp. 103–108; no. 904, pp. 133–146; no. 905, pp. 167–172. London, April-June 1932.

HARTMAN (E.) & WU (P. K.). **Some Observations on experimental Disease in Silkworms** [*Bombyx mori*, L.].—*Lingnan Sci. J.*, xi, no. 1, pp. 69–75, 2 refs. Canton, 30th March 1932.

ROARK (R. C.). **A Digest of the Literature of *Derris* (*Deguelia*) Species used as Insecticides, 1747–1931** [with a subject index].—*Misc. Pub. U. S. Dept. Agric.*, no. 120, 86 pp. Washington, D.C., April 1932.

PUSSARD (R.). **Sur la présence en France d'***Anuraphis persicae-niger* **Smith.** (**Hem. Aphididae.**)—*Bull. Soc. ent. Fr.*, xxxvii, no. 7, pp. 110–113, 8 refs. Paris, 1932.

Two quite distinct species of peach aphis occurring in the Rhône Valley have hitherto been confused, namely, *Anuraphis amygdali*, Buckt., and *A. persicae-niger*, Smith, the former often having been figured with biological notes relating to the latter. *A. persicae-niger* has been recorded in America, South Africa and Italy and has apparently been present in the Lyonnais district for at least 20 years. Observations in this district have shown that a certain proportion of the Aphids remain on the roots of peach trees throughout the year, but during the early part of April the wingless parthenogenetic females begin to ascend to the branches, many of them being carried by ants, and breed there until June, causing slight malformations of the growing shoots. From early May to mid-June winged females appear, the rôle of which is unknown, and in June most of the wingless females left on peach trees migrate to the roots. A few parthenogenetic females remain on the trees above-ground and, if they survive the winter, may reproduce rapidly in the early spring. It is not known whether sexual forms and eggs occur, but the author has confirmed by observation the statement that the species can maintain itself on peach by parthenogenetic reproduction alone. At 6–11°C. [42·8–51·8°F.], the apterous parthenogenetic female matures in about 30 days, the reproduction period occupying from 15 to 20. Peach trees of all ages are attacked, but more particularly young ones, which rapidly wither in consequence. When old trees exhibit yellowing of the leaves, *A. persicae-niger* should be searched for on the roots. In 1929 this Aphid was observed to be attacked by a mite, *Bochartia kuyperi*, Oudms.

A. amygdali, of which the wingless parthenogenetic female is compared with that of the above species, appears in isolated colonies on peaches during May and is chiefly noticeable in June, when the colonies congregate on the lower surface of the leaves, which they damage considerably; the parenchyma becomes blistered, the edges of the leaves curl and the whole leaf becomes shrivelled. In July this species is extremely abundant and takes the place of *A. persicae-niger*, which has by that time descended to the roots, but it is heavily attacked by parasites, particularly *Aphidius cardui*, Marsh., as well as by predators. Though almost disappearing from peach trees, a few colonies may be observed until October or November, when sexuales (apterous females and winged males) have been seen, indicating that eggs must be deposited on peach trees. This Aphid also occurs on almond, apricot and various species of *Prunus*, and it is probably winged individuals from these food-plants that re-infest peach trees in June.

SPRENGEL (L.). **Die Bekämpfung der Kirschfruchtfliege** (*Rhagoletis cerasi* **L.**). [The Control of the Cherry Fruit-fly.]—*Anz. Schädlingsk.*, viii, no. 5, pp. 49–51. Berlin, May 1932.

In view of the expected abundance of *Rhagoletis cerasi*, L., on cherries in Germany in 1932, various bait-sprays and proprietary contact sprays and dusts are recommended against the adults. In small orchards dusting can be effected by placing the insecticide on a piece of permeable fabric about 1 yard square, binding the four ends together, and tying

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this bag to a pole. In showery weather dusts are preferable to sprays. The correct date for insecticide application is when the cherry stone has hardened and become attached to the pulp, which should be $\frac{1}{5}$ inch thick. A second, and if necessary, a third application should follow at intervals of 4–6 days.

BÖRNER (C.). **Apfel- und Dorn-Blutlaus.** [The Woolly Aphis of Apple and Thorn.]—*Anz. Schädlingsk.*, viii, no. 5, pp. 52–54. Berlin, May 1932.

Commenting on de Fluiter's paper on *Eriosoma lanigerum*, Hausm., in Holland [*R.A.E.*, A, xx, 2], the author draws attention to the fact that the bred fundatrices did not produce leaf galls on elm, and even refused to feed on *Ulmus americana*, *U. campestris*, and apple. He believes that the host-changing Aphid of American elm that has been regarded as *E. lanigerum* is *E. crataegi*, Oestl., which occurs on *Crataegus* and which he considers distinct [*cf.* iii, 421; vi, 311]. The morphological differences between *E. lanigerum* and *E. crataegi* are slight, and it is improbable that a third species of *Eriosoma* with similar habits occurs on the same food-plants in America. Neither in America nor in Europe has it proved possible to transfer the true *E. lanigerum* of apple from apple to American elm through sexuparae and sexuales. This view is supported by the absence of leaf-galls on elms in California, where *Ulmus americana* grows wild and *E. lanigerum* is a serious pest of apple, coupled with the fact that *E. crataegi* occurs only in the eastern United States. It is only with *E. crataegi* that American workers have effected successful transfer from galls of American elm to *Crataegus crus-galli*, *C. punctata*, *Sorbus americana* and apple, and have observed the return of the sexuparous alatae both experimentally and in the field. The transfer of *E. lanigerum* has failed with the above species of *Crataegus*, and with *Sorbus* spp., though some other species of *Crataegus*, *Cotoneaster horizontalis* and *Pyrus* are infested either temporarily or permanently.

GOETZE (G.). **Zwei neue Methoden zum quantitativen Studium der Giftigkeit von Insektiziden.** [Two new Methods for the quantitative Study of the Toxicity of Insecticides.]—*Anz. Schädlingsk.*, viii, no. 5, pp. 54–57, 2 figs. Berlin, May 1932.

Quantitative tests of the toxicity of stomach insecticides are usually made with chewing insects, but the author has for many years employed a method that allows of accurately dosed administration of the poison to sucking insects and a very uniform supply of insect material. Bees are the insects used, and as they are very susceptible to most insecticides, considerable dilutions are necessary (upward from 1 in 10,000 for arsenicals or 1 in 100,000 for pyrethrum). The poison is diluted with a solution of 2 parts honey and 1 part distilled water, and the solution is filled into capillary pipettes, 1 c.c. pipettes with 0·01 c.c. divisions being used. The filled pipettes are laid on their sides, capillarity retaining the fluid, which can be reduced by sucking up the excess with filter paper. The bees are taken from a colony, kept for about half an hour (never more than an hour) without food, and then put singly into cylindrical gauze cages measuring about 1 inch in diameter by 3 inches in length. One end of each cage has a hole accommodating the tip of a pipette.

A method of recording in definite degrees the amount of injury done to insects by an insecticide was worked out in connection with tests of five different pyrethrum powders on *Calandra granaria*, L. In each test 20 beetles were placed in a corked glass tube with a definite quantity of powder. After 24 hours the beetles were transferred to a clean tube closed with cotton wool. They were shaken to the bottom of the tube, which was then laid on its side on squared paper (millimetre divisions). The beetles began moving along the tubes, and the distance they covered was the measure of the injury suffered. A short distance indicated great injury, whereas if all the beetles clustered at the wad of cotton wool, the powder was evidently almost inactive. Experiments were also made with the pyrethrins extracted from the powders tested. They were dissolved in acetone so that 1 c.c. corresponded to 1 gm. powder, and the solution was then diluted with 1, 2, 4 and 10 parts of a solution of acetone and 25 per cent. water. Acetone with 25 per cent. water added has been found not to affect *C. granaria* permanently. The beetles were dipped for 20 seconds, lightly dried off, placed in clean tubes, and left for a day to recover from shock. The tubes were then laid on squared paper, and the distance the beetles covered was measured as above. The results approximated to those with the powders. The pyrethrin content of the powders was determined chemically by the Gnadinger and Corl method, and a certain parallel was found between high pyrethrin content (as ascertained chemically) and increased injury. Certain discrepancies occurred, however, and were maintained with bees and the pipette method, thus proving the need for physiological tests.

VON OETTINGEN (H.). **Ueber die Schädigungen der Kulturgräser durch Thysanopteren.** [On the Injuries to cultivated Grasses by Thysanoptera.]—*Z. PflKrankh.*, xlii, no. 6, pp. 274–297, 14 figs., 36 refs. Stuttgart, 1932.

This paper discusses in detail the injury done to the internal tissues of grasses by the sucking of Thysanoptera. The external evidences of infestation by them are also described.

BARNES (H. F.). **On the Gall Midges injurious to the Cultivation of Willows. I. The Bat Willow Gall Midge** (*Rhabdophaga terminalis* **H. Lw.**).—*Ann. Appl. Biol.*, xix, no. 2, pp. 243–252, 2 pls., 13 refs. Cambridge, May 1932.

The larvae of several species of gall-midges are responsible for serious damage to willows grown for commercial purposes in the British Isles. They may be divided into three groups, namely, those that destroy the terminal bud or growing point and so cause the production of side shoots ; those that live in the stems, with a result that rot is liable to develop; and those that cause galls on the leaves. A detailed account is given of observations on the bionomics of *Rhabdophaga terminalis*, H.Lw., which oviposits in the terminal buds of *Salix coerulea* and *S. alba* var. *vitellina*, the former being preferred. It is not known to attack other species of *Salix* but sometimes occurs on them as an inquiline in galls of *R. rosaria*, H.Lw. It is particularly injurious to *S. coerulea*, which is grown for the manufacture of cricket bats, as it is essential that the sets should be free from side shoots. Natural enemies, which include *Anthocoris nemorum*, L., and tits, do not play an important part

in holding the midge in check, but weather conditions probably influence its incidence in the field. Artificial control measures include handpicking the galls where labour is cheap, and intense cultivation to kill the larvae, which are all in the soil in March and April. Hedgerow *Salix* bushes should be destroyed, since they harbour galls of *R. rosaria* and so may act as reservoirs of infestation.

TATTERSFIELD (F.) & GIMINGHAM (C. T.). **The insecticidal Properties of *Tephrosia macropoda* Harv. and other Tropical Plants.**—*Ann. Appl. Biol.*, xix, no. 2, pp. 253–262, 6 refs. Cambridge, May 1932.

An account is given of preliminary experiments conducted during 1926–27 to determine the insecticidal value of extracts of various plants, most of which are used in tropical regions as fish poisons. A list is given of a large number of plants tested, practically all of which were received in a dry condition. The plant material was ground finely and extracted with alcohol or water, and the extracts were diluted with a 0·5 per cent. solution of non-toxic saponin. They were then tested as contact sprays on *Aphis rumicis*, L., by means of an apparatus already noticed [*R.A.E.*, A, xii, 225]. Only three plants, *Mundulea suberosa* from India, *Neorautanenia fisifolia* from Southern Rhodesia and *Tephrosia macropoda* from Natal, showed definite toxicity, and further tests were confined to them, alcoholic extracts being used except where otherwise stated. The results, which are tabulated, showed that extracts of the roots and to a less extent of the stems of *Tephrosia macropoda*, used at concentrations equivalent to 1, 0·5, and 0·25 per cent. of the plant material against *A. rumicis* and the larvae of *Selenia tetralunaria*, Hfn., and *Notolophus* (*Orgyia*) *antiquus*, L., possessed considerable toxicity as a contact insecticide, whereas those of the leaves were of little value. The plant is apparently common in certain areas in Natal and could probably be cultivated with comparative ease. Extracts of the stems, seeds and pods of *Mundulea*, tested against *A. rumicis* at concentrations of 1, 0·5 and 0·25 per cent., gave a mortality of 100, 100, and 20 per cent. respectively after 3 days. The stems were the most active part of the plant ; and the roots and leaves did not show any appreciable degree of toxicity even at 1 per cent. concentration. Other specimens of the same plant received from South Africa, which included stems, bark cork and leaves, were, however, of little value. Both alcoholic and aqueous extracts of the roots of *Neorautanenia* proved toxic to *A. rumicis*, concentrations of 1, 0·5 and 0·25 per cent. of the alcoholic extract killing 100, 80 and 70 per cent. of the Aphids respectively in 3 days.

Spraying tests were also made with alcoholic extracts of the stems of *Lonchocarpus* sp. (black haiari), which had already been found toxic to *A. rumicis* [xiv, 512]. They proved very effective as a contact insecticide against the larvae of *S. tetralunaria* and *N. antiquus*, the older larvae being more resistant than the younger ones. A single experiment with an old extract of the stems against young larvae of the Noctuid, *Monima* (*Taeniocampa*) *gothica*, L., indicated that this species is highly resistant. Probably, however, alcoholic extracts may lose toxicity if kept for some months. All plants so far examined that possess both insecticidal and fish-poisoning properties belong to the order Leguminosae.

Tattersfield (F.). **Laboratory Methods for evaluating Insecticides.**—*Ann. Appl. Biol.*, xix, no. 2, pp. 281–290, 3 diag., 19 refs. Cambridge, May 1932.

The author reviews in some detail various laboratory methods for determining the toxicity of insecticides. He considers that of the two alternative methods employed for judging their relative effectiveness, namely the ratio of doses required to produce the same effect, or the ratio of the effects produced by equal doses, the nature of the characteristic curves leaves no option but to choose the former. The time factor, however, is more subtle. There is a startling difference between the rapidity of effect of pyrethrins on the one hand and rotenone on the other, since whereas the rapid narcosis produced by the pyrethrins may wear off at concentrations below a certain level, the narcotic effect of rotenone deepens in intensity with time. Thus the time factor in producing narcosis has importance, and more stress should be laid upon it. Another important factor is the dosage required to inhibit reproduction in such insects as Aphids, since there are several compounds that are capable, below certain levels of concentration, of rendering the adult apparently moribund, but do not paralyse its power of reproduction. Moreover, in the field of applied biological and biochemical research there are still some problems that are to be solved, such as seasonal variation in the resistance of insects, the mode of action of the insecticides, etc.

Cann (F. R.). **Laboratory Tests of Insecticides for Use against Woodboring Insects.**—*Ann. Appl. Biol.*, xix, no. 2, pp. 291–294, 3 refs. Cambridge, May 1932.

Experiments on treating wood samples with chemicals to prevent attacks by *Lyctus* have been already noticed [*R.A.E.*, A, xix, 73]. The results of tests with insecticides against Anobiids infesting timber, which were somewhat inconclusive, are also discussed.

Servadei (A.). **Reperti sull' *Agria mamillata* Pandellé. (Diptera-Sarcophagidae.)** [Data on *Sarcophaga affinis*, Fall.]—*Boll. Lab. Ent. Bologna*, iv, pp. 73–76, 2 figs., 1 pl. Bologna, 1931. [Recd. May 1932.]

The Dipterous larva obtained from the apple and *Crataegus* races of *Hyponomeuta padellus*, L., in Emilia [*R.A.E.*, A, xix, 441] has been bred out and proves to be *Sarcophaga affinis*, Fall. (*Agria mamillata*, Pand.). The information regarding the biology and artificial dissemination of this Sarcophagid, which has one generation a year, are substantially the same as already noticed [*loc. cit.*]. A description of the mature larva is given.

Goidanich (A.). **Gli insetti predatori e parassiti della *Pyrausta nubilalis* Hübn.** [The Insects predacious and parasitic on *P. nubilalis*.]—*Boll. Lab. Ent. Bologna*, iv, pp. 77–218, 33 figs., 2 pls., 212 refs. Bologna, 1931. [Recd. May 1932.]

This important contribution to a series of papers [*R.A.E.*, A, xvii, 330; xix, 330] on the insect fauna of hemp [*Cannabis sativa*] deals at length with the parasites and predators attacking *Pyrausta nubilalis*, Hb., the most serious pest of this crop in Italy. All the 116 species of

parasites, hyperparasites and predators recorded from it in various parts of the world up to the end of 1931 are surveyed, with notes on their distribution and in many cases their synonymy, morphology and biology. In Italy hemp and maize are the two plants chiefly attacked by *P. nubilalis*. Many natural enemies are more readily able to reach it in the former than in the latter, partly because in hemp the plant tissue covering the young larvae is much thinner than in maize, thus facilitating the deposition of parasite eggs, and partly because Chrysopid and other predators easily gain access to the interior of the hemp stem through the cracks arising when the mined stem breaks. Another matter of interest is the occurrence of areas in which *P. nubilalis* is intensely parasitised. The author's discovery of such an area near Castelmassa, in the Province of Rovigo, led to the establishment there of a station for supplying parasites to the United States. The author's own observations were made in the region of the lower Po from 1926 to 1931, with particular reference to the biology of the parasites in the field and the external morphology of the species bred by him.

A classified list is given of the natural enemies recorded in Italy, namely, 2 Neuroptera, 1 Coccinellid, 1 Phorid, 7 Tachinids, 14 Ichneumonids, 5 Braconids, 3 Chalcidoids, and 4 ants, and their parasites are also mentioned. The species personally observed by the author and studied at more or less length are : *Chrysopa prasina*, Burm. (parasitised by an Ichneumonid, *Hemiteles aestivalis*, Grav.) ; the Ichneumonids, *Phaeogenes nigridens*, Wesm., and *Microcryptus abdominator*, Grav. (both parasitised by *Eupteromalus nidulans*, Thoms. (Masi) [*cf.* xviii, 151]), *Eulimneria* (*Limnerium*) *alkae*, Ell. & Sacht. (parasitised by *Hemiteles hemipterus*, F., *Pezomachus* sp., *Pimpla roborator*, F., *Mesochorus confusus*, Hlgr., *Dibrachys* sp., *Homoporus* sp., and *Melittobia acasta*, Wlk.), *Angitia punctoria*, Rom. (parasitised by *P. roborator*, *E. nidulans*, *Habrocytus* sp., and *Eupelmus urozonus*, Dalm.), and *Pristomerus vulnerator*, Panz. ; the Braconids, *Microbracon brevicornis*, Wesm. (parasitised by *Eupteromalus* sp. and *Habrocytus* sp.), *Chelonus annulipes*, Wesm., and *Microgaster globatus*, L. (parasitised by *H. hemipterus*, *P. maculator* and *E. nidulans*) ; *Eulophus viridulus*, Thoms. ; the ant, *Tetramorium caespitum*, L. ; and the Tachinids, *Zenillia roseanae*, B. & B., and the species commonly known as *Ceromasia senilis*, Mg., for which the author follows Villeneuve [xix, 71] in adopting the name *Lydella stabulans grisescens*, R.-D. The last-named is parasitised by *Mormoniella vitripennis*, Wlk. (*Nasonia brevicornis*, Ashm.), *E. nidulans*, *Habrocytus* sp., and *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.). There is also a Phorid fly, *Megaselia goidanichi*, Schmitz, which is saprophagous and has a probable tendency to parasitise the larvae of *P. nubilalis* ; it is parasitised by an undetermined Pteromalid.

HERMAN (F. A.). **Petroleum Oil, Source and Method of using as an Insecticide.**—*22nd Ann. Rep. Quebec Soc. Prot. Plants 1929–30*, pp. 19–26. Quebec, 1931. [Recd. May 1932.]

The author discusses the characteristics of crude petroleum oils as obtained in the United States, and of the fractions refined from them. He also reviews the various types of emulsions that are made from oils for insecticidal work, with a very brief note on the specifications necessary for the latter. A glossary of terms used in the petroleum industry is appended.

Longley (R. P.). **An economic Study of Spraying and the Apple Crop.**—*22nd Ann. Rep. Quebec Soc. Prot. Plants 1929–30*, pp. 27–29. Quebec, 1931. [Recd. May 1932.]

Data have been collected from 96 growers in Nova Scotia with a view to determining the influence of spraying and dusting on the yield of apples. The results demonstrate a clear increase in yield corresponding to an increased amount of spray, and this holds good with slight fluctuations from an expenditure of $2 per acre, yielding an average production of 16·2 barrels, to an expenditure of $24 per acre, yielding an average production of 85. There is, however, a limit beyond which increased spray costs will not correspondingly influence yields.

Petch (C. E.). **Control of Plum and Apple Curculios.**—*22nd Ann. Rep. Quebec Soc. Prot. Plants 1929–30*, pp. 33–34. Quebec, 1931. [Recd. May 1932.]

Studies of the control of the plum and apple curculios [*Conotrachelus nenuphar*, Hbst., and *Trachypterellus quadrigibbus*, Say] on apple in Quebec indicate that insecticides should be applied during the late pink and early calyx stages. *C. nenuphar* is generally more easily controlled than *T. quadrigibbus*, as each individual eats a far larger proportion of the surface of the fruit. Dusts or sprays containing calcium arsenate gave as high as 97 or 98 per cent. control in experiments, while untreated plots showed injury to all the fruit, but thorough covering of the fruit is essential.

Petch (C. E.). **Notes on the Borer Mixture Calcium Cyanide and raw Linseed Oil.**—*22nd Ann. Rep. Quebec Soc. Prot. Plants 1929–30*, pp. 35–36. Quebec, 1931. [Recd. May 1932.]

It was thought that raw linseed oil mixed with calcium cyanide dust might become impregnated with the cyanide and, penetrating the bark and wood of trees, might be toxic to borers within. Tests of oil filtered from mixtures, however, demonstrated that the oil merely acts as an inert carrier of the poison. Experiments made by the American Cyanimid Company are quoted from which it is concluded that both castor oil and linseed oil reduce the evolution of hydrocyanic acid gas from calcium cyanide, the latter to a greater degree than the former in the first few hours. Hydrocyanic acid is, however, more soluble in castor oil than in linseed oil, and the gas is evolved from linseed oil more rapidly than from castor oil in the later hours. Neither oil showed any advantage over the other when used in the field.

Cameron (J. M.). **The Apple and Thorn-leaf Skeletonizer** (*Hemerophila pariana* **Clerck**).—*22nd Ann. Rep. Quebec Soc. Prot. Plants 1929–30*, pp. 37–43, 13 refs. Quebec, 1931. [Recd. May 1932.]

An account is given, largely from the literature, of *Hemerophila pariana*, Clerck, which, since its first discovery in America in 1917, has spread rapidly and has now been found in the Province of Quebec, cocoons being observed in an orchard in the autumn of 1929. The stages of the moth are described, and the life-history, so far as it is known in the United States and Canada, where the chief food-plant is apple, is discussed [*R.A.E.*, A, xi, 381 ; xix, 43]. There are three

generations and perhaps a partial fourth in the more southern regions of its occurrence and only two in the more northern ones. The moths fly by day for about a month, being attracted to all kinds of flowers, and go into hibernation when these die off with the early frosts.

The author has reared the following parasites in Nova Scotia from cocoons gathered in the orchards : *Pimpla* (*Itoplectis*) *conquisitor*, Say, and another species of the same genus, which is probably the undescribed male of *P. leavitti*, Cush., *P.* (*Epiurus*) *indagator*, Cress., *Phaogenes* sp., *Triclistus curvator*, F., *Microbracon gelechiae*, Ashm., *Sympiesis bimaculata*, Crwf., and *Nemorilla floralis*, Fall. Many other parasites have been previously recorded from Connecticut and from Europe [xi, 382]. Only one of the European parasites, *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.), has been found attacking *H. pariana* in America (New York). The ordinary schedule of lead arsenate sprays is generally sufficient to control the pest ; if only two after-blossom sprays are applied, a special application in early or mid-July may be necessary. The calyx application alone is usually sufficient to control the first generation, the later spray being directed against the second.

DE GRYSE (J. J.). **Some Methods in the Study of Physical Conditions affecting Forest Insects.**—*22nd Ann. Rep. Quebec Soc. Prot. Plants 1929–30*, pp. 79–85, 5 figs., 16 refs. Quebec, 1931. [Recd. May 1932.]

The author gives a brief sketch of the principal characteristics of the forest climate and some simple methods of measuring them, but no mention is made of their relation to insect life. He describes methods of ascertaining soil temperatures at different depths, air temperatures and relative humidity, wind velocities, precipitation, and the humidity of the ground surface in a forest. For measuring the evaporating power of the air, the Livingstone porous cup atmometer is generally used, and in connection with this, special mercury valves for excluding rain from the reservoirs, including one designed by the author, are briefly discussed.

DUNN (M. B.). **An Investigation of *Monochamus* Beetles and their Control.**—*22nd Ann. Rep. Quebec Soc. Prot. Plants 1929–30*, pp. 86–88. Quebec, 1931. [Recd. May 1932.]

Among the most destructive secondary enemies of conifers in Canadian forests are the beetles, *Monochamus scutellatus*, Say, and *M. notatus*, Drury, which follow the forest fires and completely destroy large areas of fire-damaged trees. The methods of preventing damage by these species are described [*R.A.E.*, A, xviii, 109]. The formula given for the lime-sulphur dust used on the skidways to repel the adult beetles is : 70 per cent. calcium polysulphide, 5 per cent. calcium thiosulphate, 10 per cent. sulphur and 15 per cent. inert ingredients.

WATSON (E. B.). **The Hemlock Looper infesting Balsam in the Province of Quebec.**—*22nd Ann. Rep. Quebec Soc. Prot. Plants 1929–30*, pp. 89–91. Quebec, 1931. [Recd. May 1932.]

An account is given of the outbreak of the hemlock looper [*Ellopia fiscellaria*, Gn.] on balsam (*Abies balsamea*) in Quebec in 1928, which was the first record of its attacking balsam in Canada, though it must

have been present for some years previously. It is estimated that about 90,000 acres were involved, the balsam, which provides valuable pulpwood, being completely defoliated and beginning to die in the following winter. In the following summer the outbreak came to an end, probably as a result of unfavourable weather conditions; enormous numbers of larvae hatched in June but failed to reach maturity.

[Ritchie (A. H.).] **The Coffee Hawk Moth. Recent Outbreak in Western Arusha.**—*Tanganyika Rev.*, ii, no. 12, p. 8. Arusha, April 1932.

Brief reference is made to a local outbreak of the Sphingid, *Cephonodes hylas*, L., during late February and early March on several coffee plantations in Tanganyika, which revealed the serious potentialities of this pest. The larvae occur at the time that the late application of lime-sulphur is made against thrips or the earlier applications of Bordeaux mixture are made against the fungus, *Hemeleia*, and it is suggested that lead arsenate should be added to one of these sprays at the rate of $\frac{3}{4}$–1 oz. or more per gallon, according to the age of the caterpillars.

Harris (W. V.). **The Migratory Locust.**—*Pamph. Dept. Agric. Tanganyika*, no. 6, 18 pp., 3 figs., 8 refs. Dar es Salaam, 1932.

An account is given of observations in Tanganyika on the bionomics and control of *Locusta migratoria migratorioides*, Rch. & Frm., all stages and phases of which are described. The present outbreak of this locust, which began in February 1931, was preceded by the appearance of small swarms of *Schistocerca gregaria*, Forsk., during March–May 1928 and in November 1929, and of small swarms of *Nomadacris septemfasciata*, Serv., in May 1930. A similar cycle of events occurred between the years 1890 and 1901 except that *N. septemfasciata* was the last of the three locusts to appear. During the intervening years *S. gregaria* was the only species to recur, namely in 1903–4 and 1914–15. Keys are given for distinguishing these species and *Anacridium moestum*, Serv.

The origin of the present infestation by *L. migratoria migratorioides* is discussed [*cf. R.A.E.*, A, xix, 709], the main line of flight into Tanganyika being from north to south along the eastern and western borders of Lake Victoria and changing to a westerly direction between 2°50′ and 4°50′ S. Lat. The first recorded egg-laying occurred on 8th and 9th March, and hatching began on 21st and was almost complete two days later. The durations of the development period of 3 batches of hoppers, of which two were reared during March–April, one in the field and the other in cages, the third being the progeny of the latter reared in cages in August–September, were 37–38, 54, and 37–38 days respectively. Adults became sexually mature in about 2 months during the rains, and in about 6 months during the dry period. Although areas with sparse vegetation were favoured by ovipositing females, no particular type of soil was observed to be preferred for egg-laying. The movements of the hoppers on hatching are discussed; noise, such as clapping of hands or beating the ground, had no appreciable effect on them until the third instar was reached. The

food-plants of the hoppers consisted of graminaceous plants and various sedges. In general they restricted themselves to young plants and showed a preference for pasture grasses.

Natural enemies include the Carabids, *Anthia artemis*, Gerst., *A. aequilatera*, Klug, and *A. maculicollis*, Perr. (*striatopunctata*, Guér.), which have been observed attacking fifth instar hoppers, and larvae closely resembling those of *Stomatorrhina lunata*, F., attacking the egg pods. Nematode worms of the genus *Mermis* and red mites were found infesting hoppers and adults. Large numbers of tracheal mites resembling *Acarapis* were discovered in the thoracic sacs and the tracheae. Attempts to infect caged locusts with the fungus, *Empusa*, were unsuccessful. Control measures include dusting or spraying with sodium arsenite, and the use of poison baits.

Pettey (F. W.). **The Codling Moth and Export of Apples to Kenya.**—*Fmg. S. Afr.*, 1931, reprint no. 60, 2 pp. Pretoria, August 1931. [Recd. June 1932.]

Apples exported from South Africa and accompanied by a certificate of inspection were found, on arrival in Kenya, to be infested with the codling moth [*Cydia pomonella*, L.]. It is impossible to guarantee by close inspection of the outer surface of apples that the fruit is not infested, since infestation frequently begins in the calyx cup, and all evidence of even mature larvae is hidden by the sepals that cover it. Methods of controlling the pest in orchards are briefly reviewed, and to avoid the escape of detection of infested apples, growers are advised to inspect and sort the apples as soon as they are harvested and then retain them in store at ordinary room temperature for 2–3 weeks, after which they should be again inspected. Only the most careful co-operation by growers can prevent the total prohibition of the import of South African apples by the Kenya Government.

Ripley (L. B.) & Hepburn (G. A.). **New Fruit-fly Baits.**—*Fmg. S. Afr.*, 1932, reprint no. 35, 2 pp. Pretoria, April 1932.

In view of the successful results obtained in Western Australia with the use of Clensel as a bait for the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] [*R.A.E.*, A, xix, 647], investigations have been undertaken in South Africa as to its efficacy as compared with that of the pollard bait recommended there for trapping this species and the Natal fruit-fly [*C. rosa*, Ksh.]. It has not been found sufficiently attractive to *C. rosa* at either Cedara or Durban to warrant its use in these areas. The data regarding *C. capitata* are not yet sufficiently complete to be conclusive, as this species is not usually numerous enough in Natal to enable trapping experiments to be carried out with it. Recent tests during an outbreak at Durban, however, indicate that this bait is more attractive to it than to *C. rosa*, though less effective than the pollard bait. On the other hand, reports of its superiority to the latter have been received from certain farmers, and it seems probable that the relative efficacy of the two baits varies according to climatic conditions. Growers in areas infested with *C. capitata* are strongly advised to test these baits in glass fly traps, six being sufficient for the purpose, before abandoning the use of the pollard bait. The traps are essential for comparative tests, as flies poisoned by pollard bait in an open container leave it before dying.

DE FRANCOLINI (J.), RÉGNIER (P. R.) & RUNGS (C.). **La mouche des fruits** (*Ceratitis capitata*, **Wied.**). —[*Pub.*] *Déf. Cult. Dir. Gén. Agric. Comm. Colon.* [*Morocco*], no. 5, 27 pp., 1 pl., 1 fig. Rabat, March 1932. **La mouche des fruits.**—*Memento Déf. Cult. Dir. Gén. Agric. Comm. Colon.* [*Morocco*], no. 5, 4 pp. [Rabat] February 1932.

These two accounts of the biology and control of *Ceratitis capitata*, Wied., are intended to familiarise fruit growers in Morocco with the most recent knowledge concerning this fly and the measures developed against it in the various parts of the world in which it has become a serious pest. The first paper gives a description of all stages, a full account of its geographical distribution and habits, and a list of its numerous food-plants. Methods of control practised in various parts of the world are grouped according to the stage of the fly against which they are directed, and include chemical and biological measures.

La mouche de l'olive (*Dacus oleae*, **Rossi**).—*Memento Déf. Cult. Dir. Gén. Agric. Comm. Colon.* [*Morocco*], no. 6, 6 pp. [Rabat] 1932.

A brief account is given of the bionomics and control of *Dacus oleae*, Gmel., in Morocco. As the adults that pass the winter in oil mills contribute very largely to the infestation in the spring, control measures are recommended against flies completing their development in stored olives. These consist of fitting very fine wire gauze to all windows and apertures to prevent the escape of the flies; daily sweeping of mills followed by burning of refuse collected; spraying with disinfectants of the type used against house-flies; and careful cleaning, whitewashing and disinfecting of the mills at the end of the season.

BOUHELIER (R.) & others. **La lutte contre les cochenilles nuisibles aux aurantiacées.**—[*Pub.*] *Déf. Cult. Dir. Gén. Agric. Comm. Colon.* [*Morocco*], no. 6, 60 pp., 10 figs., 14 refs. [Rabat] March 1932.

A general account is given of Coccids as pests of *Citrus*, in view of the severe damage they are causing in Morocco and their rapid spread. The various methods of control are discussed and described in detail. Fumigation with hydrocyanic acid gas is recognised as very efficacious, but is only practicable over large areas and on a co-operative scale. Mineral oils, which have recently been used with considerable success, and polysulphides and resinates are recommended for supplementary treatment or for use on isolated estates. These cannot be employed for more than 2–4 months of the year, while fumigation can be carried on during 8 months. Work on the use of Coccinellids for biological control is briefly reviewed. Of those occurring in Morocco, *Chilocorus bipustulatus*, L., destroys large numbers of Coccids, particularly Diaspines, but is frequently parasitised by *Tetrastichus epilachnae*, Giard. Smaller species that are also valuable predators include *Scymnus apetzi*, Muls., *S. kiesenwetteri*, Muls., *S. pallidivestis*, Muls., *S. rufipes*, F., and *S. subvillosus*, Goeze, ab. *pubescens*, Panz. In Morocco, the larva of *Nefasitus fallax*, Nav., is predacious on *Pseudococcus citri*, Risso, and the larva of another Neuropteron, *Chrysopa flava*, Scop., attacks various Coccids. The Noctuid, *Eublemma* (*Erastria*) *scitula*, Ramb., destroys many species of *Lecanium*, *Saissetia* and *Ceroplastes*, and the Hymenopterous parasites of Coccids

include *Coccophagus lunulatus*, How., attacking *Coccus hesperidum*, L., and *Scutellista cyanea*, Motsch., attacking several species. In Algeria, *Aphelinus chrysomphali*, Mercet, is frequently parasitic on *Chrysomphalus dictyospermi*, Morg., and *Aspidiotiphagus citrinus*, Craw, on *Aspidiotus hederae*, Vall. Certain Psocids also attack the young when under the maternal shield. These natural enemies are not in themselves sufficient for control, but as chemical measures frequently destroy them at the same time as the Coccids, it is suggested that when natural control amounts to 75 per cent. insecticides should be discontinued.

La cecidomye des céréales (*Mayetiola destructor*, **Say. Diptère, Cecidomyidae**).—*Memento Déf. Cult. Dir. Gén. Agric. Comm. Colon.* [*Morocco*], no. 8, 4 pp. [Rabat] 1932.

Mayetiola destructor, Say, annually causes severe damage to cereals, particularly wheat, in Morocco, where it appears to occur wherever the temperature in summer is not too high or the humidity too low. A total of 100–200 eggs are laid on the leaves of the seedlings of wheat, barley, rye or wild graminaceous plants at the beginning of winter. At 10–13°C. [50–54°F.] they hatch in 6–12 days, and the larvae bore a furrow between the stem and the leaf sheath and, having hollowed a small cell at the base of the stem or occasionally at a node, feed on the sap and subsequently pupate. The larval period occupies 16–24 days and the pupal stage 22–40, the total life-cycle lasting 44–76, with an average of 60. Development continues from January to mid-July, and there are probably three or four generations annually and as many as six under particularly favourable conditions. The injury caused to the plant is described.

Platygaster minutula, D.T. (*minutus*, Lind.) parasitises the pupae of *M. destructor*, but it is of no importance in its control. To prevent infestation, rotation of crops should be practised. At harvest the stalks should be cut about 8 ins. above the ground and the stubble burnt as soon as possible, thereby destroying the pupae in the crown or the nodes at the base of the plants. All stubble should be burnt, as in many cases the signs of infestation are not visible. If this is not possible, the land should be ploughed deep and a loose light layer favourable for the development of the crop obtained. Wild graminaceous plants near the crop should be destroyed as soon as they appear or else their stalks burnt during July–August. The land should be cultivated as soon as local conditions permit, and good manures should be employed. Late maturing varieties should be sown for preference to deprive the females of the first generation (December–January) of seedlings on which to oviposit, though this is not often possible under conditions in Morocco.

Oats are attacked by an allied fly, *M. avenae*, Marchal, which has not previously been recorded from Morocco.

Mercet (R. G.). **Notas sobre Afelíninos (Hym. Chalc.), 5a nota.**—*Eos*, viii, no. 1, pp. 5–9, 6 figs. Madrid, 30th April 1932.

Coccophagus philippiae, sp. n., is described from Algeria, parasitising *Filippia oleae*, Costa, and *C. comperei*, sp. n., from the Central Sahara, parasitising *Stotzia striata*, Marchal, on *Ephedra nebrodensis*.

Gil Collado (J.). **Notas sobre Pupíparos de España y Marruecos del Museo de Madrid (Dipt. Pupip.).** [Notes on Pupiparae of Spain and Morocco in the Madrid Museum.]—*Eos*, viii, no. 1, pp. 29–41, 2 figs., 18 refs. Madrid, 30th April 1932.

Braula coeca, Nitz., has been found in a bee-hive in the province of Madrid, this being the first record from Spain.

Chopard (L.). **Sur la présence du criquet migrateur** (*Locusta migratoria* **L.) en Normandie.**—*Bull. Soc. ent. Fr.*, xxxvii, no. 8, pp. 122–123, 2 refs. Paris, 1932.

In September 1921 a male of *Locusta migratoria*, L., in the typical gregarious phase was found at Bueil in Normandy.

de Peyerimhoff (P.). **Description d'un** *Phaenops* **nouveau (Col. Buprestidae) parasite de l'***Abies numidica* **Lann.**—*Bull. Soc. ent. Fr.*, xxxvii, no. 8, pp. 125–126, 4 refs. Paris, 1932.

Melanophila (*Phaenops*) *barbeyi*, sp. n., is described from *Abies numidica* in the mountainous region of Babor (Algeria).

Balachowsky (A.). **Le pou de San-José et l'importation des fruits frais.**—*Rev. Agric. Fr.*, lxiv, no. 6, pp. 146–148, 2 figs., 3 refs. Paris, June 1932.

In view of the finding of *Aspidiotus perniciosus*, Comst., on imported apples in France [*R.A.E.*, A, xx, 256], the danger of the establishment of this Coccid in Europe is discussed, and a brief outline is given of its history in other parts of the world. It is able to adapt itself to almost any climate, and that of southern Europe seems to correspond to its ecological optimum and maximum reproductivity. Brief notes are given on its biology, with a list of its more important food-plants. Plants known to be particularly susceptible to infestation number 72 species and an additional 67 are more or less liable to attack. A decree and supplementary regulations have been promulgated prohibiting the import into France of all fresh fruit other than oranges originating from countries where *A. perniciosus* is known to occur, unless certified to be free from infestation. It is considered that equally strict regulations should be enforced against it by all European countries.

Moreau (L.) & Vinet (E.). **Peut-on prévoir l'importance des invasions de cochylis et d'eudémis.**—*Rev. Agric. Fr.*, lxiv, no. 6, pp. 149–150, 1 graph. Paris, June 1932.

After 20 years of observation on the habits of the vine moths [*Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff.] in France, it has been found impossible to predict the size of the summer generation from captures of moths made in the spring, or the extent of the following spring generation from captures made in the summer, although valuable information may be gained in regard to timing treatments for the current infestation. The size of an infestation is not necessarily indicative of the damage likely to be done by it, as the average number of inflorescences or berries destroyed by one larva varies within fairly wide limits.

By making observations of captures of moths at several points in the vineyard, it is possible to determine with sufficient exactitude the period most favourable for the application of treatments against first generation larvae. The larvae of the second generation are more difficult to reach, and it is recommended that attention should be mainly concentrated on those of the first, against which lead arsenate should be added to the two fungicide sprays applied in spring as soon as the grapes are visible.

THIEM (H.). **Heckenkirschen und Sauerdorn als Wirtspflanzen der Kirschfruchtfliege** (*Rhagoletis cerasi* **L.**). [*Lonicera tatarica* and *Berberis vulgaris* as Food-plants of the Cherry Fruit-fly, *R. cerasi*.]—*NachrBl. deuts. PflSchDienst.*, xii, no. 6, pp. 41–43, 12 refs. Berlin, June 1932.

Both *Lonicera tatarica* and *Berberis vulgaris* have been recorded as food-plants of *Rhagoletis cerasi*, L., and in 1931 at Naumburg, Germany, the infestation of the former was compared with that of cherry. Of 203, 140, and 122 picked cherries, 45·8, 36·4, and 44·2 per cent. respectively were infested, as against 26·1 per cent. of 142 berries of *L. tatarica*. Pupae were collected from the ground with a soil-sieve [*R.A.E.*, A, xx, 384]. None was found under a cherry tree from which the fruit had been picked very early. On an average the ground under *L. tatarica* contained 12 times as many pupae as that under the cherry trees, which may be explained by the berries of *L. tatarica* being left unpicked. A single pupa was found under *Lonicera alpigena*, which blooms before *L. tatarica*, and if this proves to be *R. cerasi*, *L. alpigena* may be a food-plant that is available for the flies that emerge early. No pupae were obtained under *Berberis vulgaris* or other species of *Lonicera*.

BÖRNER (C.). **Die Verbreitung der Reblaus in Deutschland nach dem Stande des Jahres 1931.** [The Distribution of *Phylloxera* in Germany as shown by the Position in 1931.]—*NachrBl. deuts. PflSchDienst*, xii, no. 6, pp. 44–45. Berlin, June 1932.

In 1931, 17 new infestations by *Phylloxera* were recorded. The work of destroying infested vineyards is proceeding regularly.

MARRINER (T. F.). **A Coccinellidae Parasite.**—*Naturalist*, no. 906, pp. 221–222, 6 refs. London, July 1932.

In the course of studies on British Coccinellids during 1918–28, a rather high mortality among the larvae of several species was found to be due to parasitism by the Phorid, *Phalacrotophora fasciata*, Fall., notes on the bionomics of which are given. The Coccinellids attacked were *Adalia bipunctata*, L., *Neomysia* (*Mysia*) *oblongoguttata*, L., *Anatis ocellata*, L., *Calvia quatuordecimguttata*, L., and *Coccinella* spp.

WILSON (S. E.). **" Powder-post " Beetles.**—*Nature*, cxxx, no. 3270, pp. 22–23. London, 2nd July 1932.

As a result of detailed observations supplemented by experiments, it can be stated that the actual food of the larvae of *Lyctus* spp. is the starch present in the cells of the wood they infest. This starch is found in the sapwood only and varies in quantity in different trees,

which explains why it is that *Lyctus* attacks only certain kinds of timber and then only the sapwood. The starch also varies in the growing tree from month to month and is present in greatest abundance in winter, the felling season for hardwoods. If felled timber is kept in the log sufficiently long (about a year), the starch disappears entirely from the sapwood, and such timber is immune from *Lyctus* infestation. If, however, it is converted soon after felling and then quickly dried, as in kiln-drying or steaming, etc., the starch remains and such timber is liable to damage ; no subsequent (seasoning) treatment can remove the liability. By seasoning susceptible species of timber in the log, damage costing many thousands of pounds a year may be saved and sapwood made valuable, instead of being (as in oak) valueless for most purposes.

Wright (C. W. B.) & Woodman (R. M.). **Problems confronting the Sprayer. I. –The Volume of Liquid needed to spray Trees of varying Sizes and Shapes.**—*Chem. News*, cxliv, no. 3794, pp. 116–122, 2 figs., 1 ref. London, 19th February 1932. [Recd. June 1932.]

In referring to previous work on estimating the actual expenses involved in spraying orchards [*cf. R.A.E.*, A, xv, 363], the authors consider that before any such figures can be given, it is necessary to consider several problems, including that of the actual amount of spray necessary to cover a tree of a certain size and variety, and this paper describes an attempt to obtain a standard expression for this amount. Before finding the amount of spray necessary to cover a tree, it is imperative to find some measure of the size of that tree.

The following is taken from the authors' summary : It is shown how, from two simple linear measurements made on the head of an apple tree, a number (" volume number ") relative to the absolute volume of the head can be calculated by the aid of a simple formula ; corrections for the fit of this formula are given for all shapes of trees likely to be met with in practice. The volume of spray used per tree varies with the development of the foliage ; with increasing foliage the volume of spray at first tends to become larger, reaches a maximum, and then decreases with full foliage. For any given variety and shape of tree, the volume of spray also naturally increases with increase in the size of the tree ; this variation is moderately regular and can be calculated for normal sizes of the variety used. But the spray used per unit volume of the tree decreases with the size of the tree, and appears to be connected with the difficulty of thoroughly spraying the topmost portions of large trees and also with the larger branches.

Schmidt (E.) & Tornow (E.). **Nachweis der Beizung von Getreide mit Quecksilber und anderen Metallgiften.** [Demonstration of the Disinfection of Cereals with Mercury and other metallic Poisons.]—*Fortschr. Landw.*, vii, no. 2, pp. 40–42. Vienna, 1932. (Abstract in *Rev. Appl. Mycol.*, xi, pt. 6, p. 361. Kew, Surrey, June 1932.)

Full details are given of an electrolytic apparatus for the detection of mercury and other heavy metals in treated seed-grain. Tests with this on rye and wheat seed in 1927 showed that the mercury does not gradually disappear by volatilisation as is often assumed.

Jensen-Storch (S. V.) & Henriksen (K. L.) Eds. **1ste Beretning over forsøg vedrørende midler mod husbukke.** [First Report on Investigations on Means against *Hylotrupes bajulus*.]—*Meddel. Udvalget til Undersøgelse af Midler mod traeødelaeggende Organismer*, no. 1, 62 pp., 17 figs. Copenhagen, 1932. Price *Kr.* 1.00.

Owing to the production in Denmark of many preparations for combating dry rot and *Hylotrupes bajulus*, L., in timber, and the widespread infestation of buildings by this Cerambycid [*cf. R.A.E.*, A, xix, 379, 740, etc.], a committee was established in 1928 to investigate the value of various methods of control. In this report, issued by the section dealing with the beetle, the remedies tested in the laboratory and in buildings are divided according to their constitution. Of the gaseous compounds, sulphur dioxide, chloropicrin, and a proprietary material showed poor expansive and penetrative power. Carbon bisulphide at the rate of 25 fl. oz. per 1,000 cu. ft. of space gave complete mortality, lower concentrations being sometimes ineffective. Hydrocyanic acid gas, produced by Zyklon B at the rate of 30 oz. per 1,000 cu. ft., proved highly effective in summer, but in winter the percentage of mortality was smaller because of the reduced respiration of the larvae. The effect was ascertained by examining larvae in pieces of infested timber removed after fumigation. Heat was tested in one instance only, and all the larvae found were dead [*cf.* xix, 379]. Of the many liquid proprietary preparations tested, only 7 had both penetrative and killing power, and tests were made to ascertain their value in preventing infestation, pieces of wood being impregnated and exposed to the larvae at temperatures of 36–37°C. [96·8–98·6°F.], which obtain in summer under a warm roof. One of the preparations proved effective throughout the whole test period of 273 days.

Hukkinen (Y.). **Die Thysanopterenlarven als Beute der Grabwespe *Spilomena troglodytes* v. d. Linden.** [The Larvae of Thysanoptera as Prey of the Fossorial Wasp, *S. troglodytes*.]—*Notul. ent.*, xii, no. 1, pp. 21–26, 13 refs. Helsingfors, 28th May 1932.

The Sphegid, *Spilomena troglodytes*, Linden, is generally stated to capture Coccids as food for its larvae. Enslin has, however, recorded it as preying on thrips, and in Finland it has been observed attacking *Anaphothrips obscurus*, Müll., and *Frankliniella tenuicornis*, Uz., which are pests of cereals.

Dragneff (—). **Una nuova specie di pidocchio delle api. Il pidocchio delle operaie** (*Pedicolus apis*) **Dott. Dragneff.** [A new Species of Bee Louse. The Louse of the Workers, *P. apis*, Dragneff.]—*Apicoltura ital.*, xxvii, nos. 9–10, pp. 181–183, 209–210, 2 figs. Ancona, September–October 1931.

Marinelli (O.). **Larva prima di *Meloë* e non *Pediculus apis*.** [Primary Larva of *Meloë* and not *P. apis*.]—*Op. cit.*, no. 11, pp. 237–244, 9 figs. Ancona, November 1931. [Recd. July 1932.]

The first paper gives a description of a supposed new louse, *Pediculus apis*, found in large numbers infesting bees in Bulgaria. The second states that the insect concerned does not belong to the Anoplura, but

is the primary larva of a species of *Meloë*, and this view is supported by C. Fuschini in an appendix. Notes are given on other Coleoptera of this genus that have been recorded in bee-hives.

KÉLER (S.). **A Contribution towards the Knowledge of the Parasites of *Oscinis frit* L.** [*In Polish.*]—*Prace Wydz. Chorób Roślin państw. Inst. naukow. Gospod. wiejsk. Bydgoszczy*, no. 11, pp. 1–3. Bydgoszcz [Bromberg], 1932. (With a Summary in English.)

In July-September 1931 adults of *Oscinella* (*Oscinis*) *frit*, L., taken near Bromberg, in north-western Poland, were found to be parasitised by the Nematode, *Tylenchinema oscinellae*, Goodey [*R.A.E.*, A, xviii, 567], which caused sterility in both sexes. About 7–8 per cent. of the females and 2·3–5·4 per cent. of the males were infested.

[SHCHELKANOVTZEV (Ya. P.).] **Щелкановцев (Я. П.). Examination of the Injury caused to Oak Wood in the Shipovsk and Tellermanovsk Forests of the Central Black Soil Zone in the Summer of 1929.** [*In Russian.*]—*Vestn. Inst. Dreves.* [*J. Forest Prod. Res. Inst.*], 1929, no. 5–6, pp. 107–123, 2 refs. Leningrad, 1930. (With a Summary in English, p. 211.) [Recd. June 1932.]

Investigations in the summer of 1929 in oak forests in the Voronezh Government showed that the drying up of an enormous number of the trees was due to their severe defoliation in previous years by the Geometrid, *Biston strataria*, Hufn. [*R.A.E.*, A, xvii, 589] followed by the attacks of secondary pests. Of these, *Lymexylon navale*, L., and the Buprestids, *Agrilus biguttatus*, F., and *A. elongatus*, Hbst., were the most important. In the Voronezh Government the two species of *Agrilus* have one generation a year. The adults occur from the end of May till mid-August, being most numerous between 10th and 20th June. Brief descriptions of the larvae and galleries of both species are given. Pupation occurs in the bark. *A. biguttatus* chiefly infests stumps, but also attacks the trunks of standing, partly dried trees that still retain some green leaves. *A. elongatus* infests only the upper parts of the trunks. *L. navale* lays eggs in places that are devoid of bark and therefore readily attacks barked stumps and timber lying in the forests, as well as squared beams in timber yards. Other borers, which were numerous and occurred everywhere, comprised: the Cerambycids, *Plagionotus* (*Clytus*) *arcuatus*, L., *P.* (*C.*) *detritus*, L., *Cerambyx scopolii*, Füssl., and *Rhagium sycophanta*, Schr., the galleries of the first two often reaching the heartwood; the Lamiids, *Leiopus nebulosus*, L., which has one generation a year, and *Mesosa curculionoides*, L., and *Saperda scalaris*, L., which, as well as *R. sycophanta*, take not less than two years to complete their life-cycle; and the Scolytid, *Xyleborus* (*Anisandrus*) *dispar*, F., which has one generation a year. *Cerambyx cerdo*, L., was rare.

For control, the speedy removal from the forests of all completely or partly dried trees that are infested is recommended, and against *A. biguttatus* the careful barking of all stumps in felled areas.

[FURSOV (N. I.).] **Фурсов (Н. И.). New Species of Coleoptera of the Family Ostomidae.** [*In Russian.*]—*Vestn. Inst. Dreves.* [*J. Forest Prod. Res. Inst.*], 1929, no. 5–6, pp. 181–183. Leningrad, 1930. [Recd. June 1932.]

This paper is the first of a projected series on the classification and ecology of Coleoptera that live in the tunnels made in trees by Scolytids

and other injurious insects, on which they usually prey. The importance of such predatory beetles is briefly discussed, and a key is given to the species of the genus *Nemosoma*, which occur in the galleries of Scolytids and attack their larvae. They include *N. curtulum*, sp. n., *N. cylindricolle*, sp. n., and *N. alasanicum*, sp. n., all of which are described in Russian and German from Transcaucasia.

Ishii (T.). **The Encyrtinae of Japan. II. Studies on Morphology and Biology.**—*Bull. Imp. Agric. Expt. Sta. Japan*, iii, no. 3, pp. 161–202, 8 pls., 68 refs. Tokyo, March 1932.

In continuation of a work previously noticed on the classification of the Encyrtids of Japan [*R.A.E.*, A, xviii, 258], an attempt has been made to determine the fundamental facts concerning their morphology and biology. The anatomy and morphology of *Aphycus timberlakei*, Ishii, as a representative species are studied, and observations based upon this species and others common in Japan are recorded in regard to biology.

Encyrtids parasitic on scale insects include *Anicetus annulatus*, Timb., *Aphycus orientalis*, Comp., *A. pulvinariae*, How., *Encyrtus barbatus*, Timb., *Microterys flavus*, How., *M. kuwanai*, Ishii, and *Pareusemion studiosum*, Ishii, which parasitise *Coccus hesperidum*, L., one of the most important pests of *Citrus*. *M. flavus* sometimes causes parasitism amounting to 50 per cent. *P. studiosum* is also an important parasite but is confined to a few fields near Nagasaki. *Ceroplastes floridensis*, Comst., a common Coccid attacking *Citrus* and certain other trees, is parasitised by *Microterys clauseni*, Comp., which sometimes destroys 70 per cent. of the scale, and *Anicetus ceroplastis*, Ishii. *C. rubens*, Mask., one of the most injurious scale insects in the southern part of Japan, where it attacks ornamental trees, is parasitised by *Microterys speciosus*, Ishii, and *Cheiloneurus ceroplastis*, Ishii. *Comperiella bifasciata*, How., is one of the most important parasites of *Chrysomphalus aurantii*, Mask., and *C. ficus*, Ashm. (*Aspidiotus aonidum*, auct.) on *Citrus*. *Comperiella unifasciata*, Ishii, destroys a fairly high precentage of *Pseudaonidia duplex*, Ckll., a minor pest of *Citrus* in Japan. This Encyrtid parasitises *Aspidiotus destructor*, Sign., in the Netherlands Indies, where it has been distributed for its control [xviii, 83]. *Microterys okitsuensis*, Comp., attacks *Pulvinaria aurantii*, Ckll., a scale injurious to *Citrus*. It is suggested that the limited incidence of *Pseudococcus* on *Citrus* in Japan is due to such parasites as *Cheiloneurus nagasakiensis*, Ishii, *Leptomastix citri*, Ishii, *Anagyrus subalbipes*, Ishii, and *Clausenia purpurea*, Ishii, the last-named being known to control a considerable percentage.

Ooencyrtus kuvanae, How., has been imported into the United States from Japan to control *Porthetria dispar*, L., the eggs of which it parasitises, and *O. nezarae*, Ishii, is parasitic on the eggs of *Nezara antennata*, Scott, which is injurious to beans.

Encyrtids attacking beneficial insects include *Homalotylus flaminius*, Dalm., which parasitises *Chilocorus kuwanae*, Silv., an important enemy of Diaspine Coccids, and *Coccinella septempunctata brucki*, Muls., which is predacious on Aphids; *Anisotylus albifrons*, Ishii, which parasitises *Scymnus* sp. destroying *Pseudococcus* sp. on *Citrus*; *Isodromus axillaris*, Timb., which parasitises *Chrysopa boninensis*, Okam., feeding on *Prontaspis yanonensis*, Kuw.; *Metacerapterocerus*

fortunatus, Ishii, which is probably parasitic on the larva of *Aphidencyrtoides thoracaphis*, Ishii, a parasite of *Thoracaphis* sp. on *Quercus glauca*; and *Tyndarichus navae*, How., said to be a parasite of *O. kuvanae*.

KUWAYAMA (S.). **Studies on the Morphology and Ecology of the Rice Leaf-beetle, *Lema oryzae* Kuwayama, with special Reference to the taxonomic Aspects.**—*J. Fac. Agric. Hokkaido Imp. Univ.*, xxxiii, pt. 1, pp. 1–132, 4 pls., 13 figs., 122 refs. Sapporo, Japan, March 1932.

The author has made a detailed study of *Lema oryzae*, Kuw. (rice leaf-beetle) [*R.A.E.*, A, xix, 294] in Japan during the last ten years, and gives the results of his investigations on the morphology of all stages, taxonomy, bionomics, distribution, etc. An annotated list is given of the species of *Lema* recorded in the Japanese Empire, including one new species and three new varieties, with a key. Among the species are *L. tristis*, Hbst. (*flavipes*, Suff.), which occurs in various parts of Japan proper, but is very rare there; *L. melanopa*, L., which has been recorded from Honshu, but the occurrence of which in the Japanese Empire is considered doubtful, reports of its presence probably referring to *L. oryzae*; *L. honorata*, Baly, which feeds on *Dioscorea japonica* in Japan; *L. formosana*, sp. n., which attacks sugar cane in Formosa; and *L. decempunctata japonica*, Wse., recorded on tea and *Lycium chinense* in Japan and also occurring in Korea. All records of *L. tristis* and *L. melanopa* on rice throughout the Japanese Empire, including Formosa and Korea, refer to *L. oryzae*. Notes are given on the bionomics and distribution of the five palaearctic species of the genus that attack graminaceous plants, with a key, differences between the morphology and bionomics of *L. oryzae* and *L. melanopa* being described.

There is only one generation of *L. oryzae* a year. The adults, which live for a year or more, enter hibernation, soon after emergence in late July and August, in débris or at the roots of grasses; they become active in late May, mate, and oviposit from early June to late July. In Formosa, the seasonal incidence is about 3 months earlier. The eggs are deposited in masses, generally on the upper surface of rice leaves, the incubation period lasting 5–11 days according to the temperature, and the larval period 13–19. Pupation occurs on the leaves and on or in the soil. Both adult and larva eat the leaves, their feeding leaving parallel longitudinal stripes in the upper epidermis. Rice is apparently the only food-plant on which the beetle can develop; the adult can feed on other cereals and grasses in the absence of rice, but with resulting shortened life and restricted oviposition; and the larvae die in 3–5 days on these plants. In cases of heavy infestation the rice plant rapidly withers, and even slight infestation causes retardation of growth.

A Mymarid, *Anaphes nipponicus*, sp. n., is an important egg parasite of *L. oryzae*; in 1929 and 1930, parasitism by it reached 51·5 per cent. in late July in one district. Larval parasites, several of which have recently been described [xix, 196], include the Pteromalid, *Trichomalopsis shirakii*, Crwf., which is widely distributed and attained an average of 11·26 per cent. parasitism in the Oshima Peninsula; and the Ichneumonids, *Anilastus japonicus*, Sonan, which parasitised an average of 11·65 per cent. of the larvae in Oshima, *Nesopimpla*

narangae, Ashm., which is an important parasite of the rice leaf caterpillar, *Naranga aenescens*, Moore, and has once been reared from *L. oryzae*, *Melcha lemae*, Sonan, and *Habrocryptus ruficoxatus*, Sonan. All the above parasites, except the last two, are described and brief notes are given on their bionomics. The Ichneumonids, *Pezomachus lemae*, Sonan, and *Bathythrix rufus*, Sonan, which are rare, and *B. kuwanae*, Vier., the adult of which is described and which has been bred from an average of 9·75 per cent. of cocoons of the beetle in Oshima, are probably secondary parasites of *L. oryzae*. All these parasites occur in Japan except *M. lemae*, of which only one individual has been taken, in Formosa. *T. shirakii* also occurs in Formosa and *B. kuwanae* in Korea. The most important predators are the Coccinellid, *Hippodamia tredecimpunctata*, L., and the Staphylinid, *Paederus fuscipes*, Curt. (*idae*, Sharp), which are described, with notes on their bionomics. The former is considered to be by far the most important of the natural enemies. Both species attack the eggs and larvae in Japan.

Nisikawa (Y.). **Chemical Properties of Solutions prepared from the Sodium Fluosilicate-Hydrated Lime Mixtures, with special Reference to their Toxicity to Plants.**—*Mem. Coll. Agric. Kyoto Imp. Univ.*, no. 21, 15 pp., 4 figs., 20 refs. Kyoto, Japan, April 1932.

Although it is generally recognised that fluosilicates are most promising substitutes for arsenicals in the control of insect pests, some of them cause somewhat severe injury to the plants. This injury is mainly attributed to the acid character and the fluorine contents of their solutions, and many authors recommend the addition of hydrated lime to neutralise this acidity. Experiments were therefore conducted to determine the toxic action on plants of solutions prepared from sodium fluosilicate and hydrated lime and the reactions concerned.

The following is taken from the author's summary: The acidity of the solutions, which at the same time represents the content of sodium fluosilicate, decreases with the addition of a small amount of hydrated lime, but their toxic action never diminishes thereby. The strong alkaline solutions from the mixtures with a larger amount of hydrated lime are harmful to vegetation. Injury by sodium hydroxide appears promptly but progresses rather slowly. The sodium fluoride content is the most important factor controlling the degree of toxicity. The injury by sodium fluoride is not severe at first, but steadily progresses with the lapse of time. When the solutions are diluted, the toxic action of sodium hydroxide is lowered to a greater extent than that of sodium fluoride, the latter becoming distinct thereby. The sodium fluoride content plays the chief part in controlling the degree of plant injury in acid solutions, and both sodium fluoride and sodium hydroxide contents are of importance in alkaline solutions. Mixtures of sodium fluosilicate and hydrated lime used as dusts under wet weather conditions or as sprays will cause severe plant injury. Mixtures containing a large amount of lime will become comparatively safe, but at the same time their toxicity to insects may be reduced.

Andrewartha (H. G.). **The Apple Curculio. Its Control by a Poison Bait.**—*J. Dept. Agric. W. Aust.*, (2) ix, no. 1, pp. 104–105. Perth, W.A., March 1932.

Otiorrhynchus cribricollis, Gyll., is spreading rapidly throughout the fruit-growing districts of Western Australia, and during the summer of

1931 it caused very severe damage on apple in orchards in which it was well established. For control, a bait of 9 lb. dried apple (minced) and 1 lb. sodium fluoride [*R.A.E.*, A, xix, 468] should be placed round the base of the tree in late November or early December, when the newly emerged adults are about to ascend the trees, and if necessary again during the third week of February after the quiescent period is over [*cf.* xix, 467]. It should be prepared from fallen or discarded apples when these are numerous during February-March (6 lb. giving 1 lb. of the dried material) and stored in tins or boxes throughout the winter. Assuming that 15 lb. bait are needed to 100 trees, the total cost including labour will be about 1*d.* a tree.

Nicholls (H. M.). **The Rutherglen Bug.**—*Tasmanian J. Agric.*, iii, no. 2, pp. 51–53. Tasmania, 1st May 1932.

The Lygaeid, *Nysius vinitor*, Bergr. (Rutherglen bug) is indigenous to Tasmania and during the last 15 years has been observed practically throughout the Island. It is normally a very minor pest, but has recently been of importance in the north-east, where it breeds on reclaimed land, along the banks of the Tamar river, that is covered with a dense growth of various succulent weeds. During the hot weather when the latter dry up, the bugs migrate and in some cases are sufficiently numerous to injure the leaves of potato. It is thought that there are about five generations during normal seasons and certainly an additional one or two during very hot ones.

Cooke (F. C.). **Investigations on Coconuts and Coconut Products.**—*Gen. Ser. Dept. Agric. S.S. & F.M.S.*, no. 8, 99 pp., 9 pls., 3 figs., 18 refs. Kuala Lumpur, 1932. Price $1.00.

Beetles found associated with copra in Ceylon were *Cathartus* (*Silvanus*) *advena*, Waltl, *Carpophilus dimidiatus*, F., *Necrobia rufipes*, DeG., *Tribolium castaneum*, Hbst., and *Tenebroides mauritanicus*, L. Estate copra stores were very much less infested than they have been found to be in Malaya [*R.A.E.*, A, xix, 646] ; in this connection it may be significant that when old bags are used for transporting copra they are usually washed or sprayed with Jeyes fluid and sun-dried.

Fischer (C. R.). **Nota taxonomica e biologica sobre** *Anastrepha grandis* **Macq. (Dipt. Trypetidae).** [A taxonomic and biological Note on *A. grandis*.]—*Rev. Ent.*, ii, fasc. 3, pp. 302–310, 10 figs. 11 refs. S. Paulo, 10th May 1932.

This study of *Anastrepha grandis*, Macq., is based on material bred from *Cucurbita* sp. at S. Paulo, Brazil. Five males and ten females were obtained after a pupal period lasting from 3rd May to 2nd and 3rd June 1930. The adults of both sexes, larva and puparium are described, and a list is given of the 39 species of *Anastrepha*, of which 16 occur in Brazil.

Hempel (A.). **Descripção de vinte e duas especies novas de Coccideos (Hemiptera, Homoptera).**—*Rev. Ent.*, ii, fasc. 3, pp. 310–339. S. Paulo, 10th May 1932.

The 22 new Coccids described include 3 new genera and are all from Brazil, except 1 from Chile. Among those from Brazil are *Icerya*

flocculosa and *Trionymus minutus* on *Citrus*, of which the former may become a serious pest; *Aclerda sacchari* on sugar-cane; *Pseudaulacaspis sordidus* on *Anona*; and *Aspidiotus symbioticus* on pear.

WILLE (J.). *Margaronia quadristigmalis* **Guén. (Lepidopt. Pyralidae), ein Grossschädling des Olivenbaumes.** [*M. quadristigmalis*, a serious Pest of the Olive Tree.]—*Rev. Ent.*, ii, fasc. 3, pp. 339–369, 10 figs., 13 refs. S. Paulo, 10th May 1932.

The chief pest of olives in Peru is *Saissetia oleae*, Bern., but in October 1930 the young shoots of trees near Lima and in the Ilo valley were severely attacked by *Margaronia quadristigmalis*, Guén. This Pyralid, all stages of which are described, occurs in North, Central, and South America. In Peru it is rare, and its distribution corresponds to the areas in which it has been observed on olives, *viz.*, the coastal region from Lima southwards to Chile. Near Lima it was also found attacking ash. The only other record of its occurrence as a pest is by C. V. Riley, who described an outbreak on privet at Washington, D.C., in 1886.

About 200 eggs are laid, at the rate of 1–12 a day. In winter (at 10–20°C. [50–68°F.]), the egg stage lasts 10–15 days, the larval 34–44 and the pupal 18–22; in summer (at 18–32°C. [64·4–89·6°F.]), the figures are 8–10, 27–35 and 10–12. There are five generations a year. The young larvae feed only on the tender leaves unfolding at the tips of the shoots; in the absence of these they die, a mortality of 70–80 per cent. having been observed from this cause. Older larvae feed on older leaves and green bark. From a distance the trees look as if singed, and the ground beneath them is covered with fallen leaves. A larva consumes at least one tip, with 6 young leaves, and 20 older leaves. Some 95 per cent. of the larvae pupate in cracks in the bark, the others among leaves spun together on the tree but never among fallen leaves. An outer cocoon is spun and a pre-pupal period of 1½–2 days then precedes the spinning of the inner one. No parasites were observed, but spiders and a Sphegid prey on the larvae. Olive trees weakened by the loss of leaves are unable to ripen their fruits, numbers of which fall, and in 1930–31 less than one-ninth of the average crop was harvested.

Control measures were not initiated until the infestation was beginning to decline with the advent of winter. Preliminary tests were made with a spray of lead arsenate and lime and various calcium arsenate dusts were tried. Of these insecticides a proprietary dust proved the best, 63 per cent. of the larvae being dead on the first day after dusting and the trees developing normally in the following spring.

HAMBLETON (E. J.). *Stephanoderes hampei* **(Ferr.) reported in the State of Minas Geraes.**—*Rev. Ent.*, ii, fasc. 3, p. 384. S. Paulo, 10th May 1932.

Stephanoderes hampei, Ferr., has been found in various coffee plantations in the State of Minas Geraes, Brazil.

REKO (V. A.). **Der Tomatenwurm.** [The Tomato Caterpillar.]—*Nachr. SchädlBekämpf.*, vii, no. 2, pp. 74–76. Leverkusen b. Köln, May 1932.

In the tomato-growing centre of Los Mochis, Mexico, only one-third of the possible crop is harvested because of damage by pests, of which

the chief is the Noctuid, *Heliothis obsoleta*, F. The average duration of a generation is 38 days, and there are five in a year, the greatest injury being done by the third, early in August. Dusting with an arsenical is a fairly effective measure, as is also the use of trap plants, such as maize alternated with flowering plants that serve to attract the moths. The soil of infested fields should be dug over in autumn or winter to expose the pupae to natural enemies and weather.

Crumb (S. E.). **The more important Climbing Cutworms.**—*Bull. Brooklyn Ent. Soc.*, xxvii, no. 2, pp. 73–100, 2 pls., 5 refs.; no. 3, p. 144. Brooklyn, N.Y., 1932.

The term climbing cutworm is applied to those Noctuid larvae that feed upon shrubs and trees and normally spend the day in concealment on the ground. Descriptions are given of the mature larvae of 30 species, with a key and notes on their food-plants and distribution in the United States and Canada. They include all but one of the climbing cutworms that have ever assumed importance as pests in these countries.

Learned (E. T.). *Eriopyga contrahens* (**Wlk.**) **in Red Pepper.**—*Bull. Brooklyn Ent. Soc.*, xxvii, no. 2, p. 112. Brooklyn, N.Y., 1932.

The author reports from New Hampshire the finding of a dead adult of the Noctuid, *Eriopyga contrahens*, Wlk., an empty pupal case and larval exuviae in a salt shaker containing paprika pepper, which had been undisturbed for a year. The moth had evidently completed its entire life-cycle upon the contents, and must have originated from an egg dropped through one of the perforations in the top.

Noble (N. S.). **Studies of** *Habrocytus cerealellae* (**Ashmead**), **a Pteromalid Parasite of the Angoumois Grain Moth,** *Sitotroga cerealella* (**Olivier**).—*Univ. Cal. Pub. Ent.*, v, no. 16, pp. 311–354, 42 figs., 13 refs. Berkeley, Cal., 1932.

A detailed account is given of observations in California during 1930–31 on the bionomics of *Habrocytus cerealellae*, Ashm., a parasite of *Sitotroga cerealella*, Ol., infesting grain. All stages of this Pteromalid and the laboratory technique adopted for its study are described.

The following is taken from the author's summary: It was found that the parasite would oviposit in host larvae extracted from the grain (wheat), thus enabling its development to be observed throughout its entire life-cycle. The longevity of the adults varied considerably under different conditions. They fed readily on sweetened solutions, a fact that increased the length of their life. Females lived longer than the males under all conditions, and at 42–46°F. some lived more than 60 days. Parthenogenetic reproduction was observed, only males resulting. The total of the progeny of four fertilised females was 1,014, of which 26·13 per cent. were males. Mating may occur within an hour after emergence, the pre-oviposition period lasting 24 hours and the oviposition period varying from 12 to 24 days. The female pierces the infested grain with its ovipositor and frequently paralyses the host larva before ovipositing on it; it may feed on the liquid that exudes through the wound. The eggs are laid singly, but superparasitism is quite common, as many as 16 eggs having been found on one host larva in the grain and as many as 32 on exposed larvae.

The pupae are not attacked. Only one adult usually emerges, the first larva to hatch generally destroying the remaining eggs and larvae. In several instances, however, two parasites were reared from a single host. Newly hatched parasite larvae will feed on mature larvae of their own species, and one individual was experimentally brought through its entire life-cycle, feeding only in this manner. Four larval stages were distinguished, there being a well marked pre-pupal period. At 75–77°F., the lengths of the various stages were : egg, 31–35 hours ; larval, 3·5–4·5 days ; pre-pupal, 1·5–3 days ; and pupal, 5–6·5 days. The life-cycle of 214 individuals averaged 13·25 days, with a minimum of 12 and a maximum of 16, that of the males being slightly shorter than that of the females. At the same temperature, the average life-cycle of the host (141 individuals) was 46·68 days, with a minimum of 33 and a maximum of 70.

Curran (C. H.). **New North American Diptera, with Notes on others.** —*Amer. Mus. Nov.*, no. 526, 13 pp., 9 figs. New York, 21st May 1932.

Among the species dealt with are several belonging to the genus *Rhagoletis*, a key to the Nearctic forms of which is given. They include *R. mendax*, sp. n., which is the insect previously regarded as the blueberry race of *R. pomonella*, Walsh [*cf. R.A.E.*, A, xix, 555, etc.], and *R. indifferens*, sp. n., which is closely related to *R. cingulata*, Lw. The last-named will not oviposit on wild cherries, whereas *R. indifferens* will not do so on cultivated ones. Similarly, *R. mendax* will not oviposit on apple nor *R. pomonella* on blueberry. Types of *R. mendax*, all reared from *Vaccinium*, originate from Maine, Nova Scotia and New Jersey, and those of *R. indifferens*, reared from *Prunus marginata*, from different localities in Oregon.

Larrimer (W. H.). **Grasshopper Outbreak in the West.**—*Science*, lxxv, no. 1951, suppl. pp. 9–10. New York, 20th May 1932.

Reference is made to the serious outbreak of grasshoppers in the United States in 1931, and a more severe one is predicted for the summer of 1932 [*R.A.E.*, A, xx, 410, 411]. An attempt is now being made to provide about £300,000, at par, from Government Funds to purchase poison bran mash and make it available to the farmer. The cost of protecting the crops is estimated at about a shilling an acre.

Muesebeck (C. F. W.). **Two new Species of *Phanomeris* Foerster (Hymenoptera, Braconidae) parasitic on leaf-mining Sawflies.**—*Proc. Ent. Soc. Wash.*, xxxiv, no. 5, pp. 81–83. Washington, D.C., May 1932.

Phanomeris metalli, sp. n., is described from *Metallus rubi*, Forbes, mining the leaves of blackberries in New York, and *P. phyllotomae*, sp. n., from *Phyllotoma nemorata*, Fall., from Austria. A few adults of the latter have been reared at the Gipsy Moth Laboratory in Massachusetts and liberated against *P. nemorata* in New Hampshire.

Drake (C. J.) & Harris (H. M.). **Asparagus Insects in Iowa.**—*Circ. Iowa Agric. Expt. Sta.*, no. 134, 12 pp., 8 figs. Ames, Iowa, February 1932.

The beetles, *Crioceris asparagi*, L., and *C. duodecimpunctata*, L., and the fly, *Agromyza simplex*, Lw., are the only serious insect pests

of asparagus in the United States. At present, *C. asparagi* is the only one that is abundant in Iowa [*cf. R.A.E.*, A, xx, 142]. The beetles first begin to appear in the spring at the time of the first cutting and attack the buds and stems of the young tender shoots. The eggs are deposited indiscriminately on the developing stalks in rows of 3–8 and hatch in less than a week. The larvae, which feed on the tips of the leaves, excrete a thick dark fluid that sometimes discolours the cuttings. After 10–15 days they enter the soil and pupate, the pupal period lasting 7–12 days. Breeding is continuous throughout the summer. Predators, which include the Pentatomid, *Podisus maculiventris*, Say, are of importance in control, and many of the mature larvae are killed by the Eulophid parasite, *Tetrastichus asparagi*, Crawf., which lays its eggs in those of the beetle.

For control in gardens, etc., hand collection, or jarring the larvae off the plants on to the ground during the hot weather, is recommended. In the case of a crop growing on a large scale, all shoots should be cut down in the spring in order to compel the beetles to oviposit on the new growth, which in turn should be cut down before the eggs begin to hatch. Thereafter the shoots should be cut off deeply, at frequent and regular intervals during the cutting season. In some instances, allowing some of the plants to grow up as trap crops and spraying them as soon as the eggs have hatched is of value. Spraying or dusting with an arsenical is considered the most effective method of controlling the pest and of protecting the plants after the crop is harvested; no poison should be applied to shoots that are to be cut for food. From two to four applications, at intervals of 10–14 days, of a spray of 2–3 lb. lead arsenate to 50 U.S. gals. water with 1 U.S. qt. miscible oil or 2 lb. resin fish-oil soap as an adhesive are usually required. For dusting, 8–10 parts (by weight) of slaked lime and 1 of lead arsenate or calcium arsenate should be used. The mixture should be applied at frequent intervals, or when the adults or larvae are particularly abundant, the best results being secured by dusting when the plants are wet with dew.

The principal injury by *C. duodecimpunctata* is caused by the overwintered adults feeding on the tender cuttings early in the spring. The eggs are laid singly on the stems of the older plants, and the larvae burrow in the berries. The above control measures, with the exception of those directed against the larvae, are also applicable to this species.

The injury caused by *A. simplex* is briefly described. The eggs are laid in the stems of the plants soon after the emergence of the adults late in spring. The larvae hatch in 12–17 days, and mine in the stalks, pupation taking place within the plant, beneath the surface of the soil. There are 3 generations a year. Pulling up and destroying the stalks containing the overwintering pupae, in late autumn or early spring, will effect control in small plantings. For large areas, thorough spraying with $\frac{4}{5}$ U.S. pint 40 per cent. nicotine sulphate in 50 U.S. gals. water containing 2–3 lb. dissolved soap is recommended. The stalks should be drenched to kill the larvae in their mines.

Other pests, which commonly feed on asparagus but do not usually require special control measures, are *Lygus pratensis*, L. (*oblineatus*, Say), *Euschistus variolarius*, P. de B., *Prodenia ornithogalli*, Guén., *Diabrotica duodecimpunctata*, F., *Diacrisia virginica*, F., *Phytometra* (*Autographa*) *brassicae*, Riley, and various grasshoppers.

Gui (H. L.). **Arsenicals in Potato Flea Beetle Control.**—*Bi-m. Bull. Ohio Agric. Expt. Sta.*, no. 156, pp. 104–111. Wooster, Ohio, 1932.

Considerable difference of opinion exists regarding the best means of controlling *Epitrix cucumeris*, Harr., on potatoes, Bordeaux mixture at various strengths, with or without the addition of lead or calcium arsenate, having been used. Subsequent to laboratory experiments [*R.A.E.*, A, xviii, 551 ; xix, 433], extensive field tests were carried out in Ohio [xx, 321], which indicated that calcium arsenate is the most efficient and economical arsenical to use with standard 4–6–50 Bordeaux mixture (4 lb. to 100 U.S. gals.) or with 20–80 copper lime dust (1 lb. to 10 lb.) for the control of this flea-beetle. With its use the yields are consistently higher and the degree of prevention of damage greater than when lead arsenate is employed ; it is also considerably cheaper.

The relative efficiency of applications early and late in the season depends on the condition of growth of the crop, but as the rate of growth cannot be predicted with any certainty, the arsenical should be used throughout the season to ensure the greatest returns. Particular attention should be given to spraying when the plants are growing rapidly, and care should be taken to cover both surfaces of the leaves. An increase in the strength of the Bordeaux mixture does not appreciably increase the efficiency of the spray in the control of *E. cucumeris*.

Spraying Program and Pest Control in the Orchard.—*Bull. Ohio Agric. Expt. Sta.*, no. 500, 49 pp., 13 figs. Wooster, Ohio, February 1932.

In this bulletin information is given on materials and programmes for spraying apples, pears, stone fruits and grapes for the control of insects and diseases in Ohio, with suggestions concerning spray practices. Brief notes are also included on the use of dusts and of paradichlorobenzene against borers.

Cox (J. A.). *Ascogaster carpocapsae* **Viereck, an important larval Parasite of the Codling Moth and Oriental Fruit Moth.**—*Tech. Bull. New York St. Agric. Expt. Sta.*, no. 188, 26 pp., 13 figs., 1 chart, 8 refs. Geneva, N.Y., January 1932. [Recd. June 1932.]

An account is given of laboratory observations during 1930–31 on *Ascogaster carpocapsae*, Vier., a mono-embryonic parasite of the codling moth [*Cydia pomonella*, L.] and oriental fruit moth [*C. molesta*, Busck] in New York. In the western part of the State, it is the only larval parasite of the former that occurs in any appreciable numbers. It has also been reared from the grape-berry moth [*Polychrosis viteana*, Clem.] in Pennsylvania, from *Gelechia confusella*, Cham. [*R.A.E.*, A, vi, 464], and by the author in the laboratory on *Ancylis comptana*, Froehl. All stages of the parasite are described. The female deposits an egg in that of its host, and the parasite larva enters the host embryo before the latter emerges from the egg membrane, but does not affect the hatching and feeding of the host larva. The adult parasites were kept in cloth-covered cages in which moisture and drinking water were supplied by a wick submerged in water ; they were fed on cubes

of granulated sugar. Waxed paper was used for receiving the host eggs, and the latter on being parasitised were confined in an incubator at a temperature of 80°F.

The following is taken from the author's summaries: In the first three instars the parasite feeds internally, but the fourth instar larva emerges after its host has spun its cocoon and feeds externally. It spins its cocoon inside that of the host. At 80°F. the pupal stage lasted 8–12 days. In western New York the development of the parasite synchronises with that of its hosts. One complete generation and a partial second mature on *C. pomonella*, and two complete generations and part of a third and fourth on *C. molesta*. Adults were present from the latter part of May until mid-September. Mating takes place soon after emergence. Unfertilised females oviposit readily, but their progeny are males. Superparasitism was quite common in the laboratory, but was not observed in the field. The maximum longevity of a female in the laboratory was 36 days and that of a male 29. The first instar larva has a decided effect upon the growth and development of the larva of *C. pomonella*. A parasitised larva is only about one-fourth or one-third as large as one that is not attacked. The effect of a second instar larva upon its host is not noticeable, but one infested by the third instar is unable to crawl. In the case of the larvae of *C. molesta*, infestation by a first and second instar larva is difficult to distinguish. The parasite hibernates as a first stage larva within the body of the host. *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.) has been reared as a secondary parasite from *A. carpocapsae*.

HARMAN (S. W.). **Summer Treatments for the Control of the Eye-spotted Budmoth.**—*Bull. New York St. Agric. Expt. Sta.*, no. 609, 16 pp., 6 figs., 6 refs. Geneva, N.Y., March 1932.

Eucosma (*Spilonota*) *ocellana*, Schiff. (eye-spotted budmoth), which has gradually risen to the status of a major pest of apples in New York State, has been the object of experimental control measures during the last four years, much of the data obtained having already been noticed [*R.A.E.*, A, xviii, 402; xx, 219, etc.]. The cover sprays for the codling moth [*Cydia pomonella*, L.] applied in July and August generally give protection against the newly hatched budmoth caterpillars if care is taken to coat the lower surface of the foliage. Sprays of 3 lb. lead arsenate or 1 U.S. pint nicotine sulphate in 100 U.S. gals., or a combination of both materials, applied about mid-July and the beginning of August will reduce the damage caused in summer and the number of larvae that hibernate. Lime-sulphur with lead arsenate sometimes causes injury, and lead arsenate applied in late summer leaves a deposit on the fruit; the use of nicotine obviates this difficulty. The moths were attracted in large numbers to bait and light traps [xviii, 469], and also proved susceptible to 2 per cent. nicotine dusts, but the practical value of these methods, either as a sole means of control or a supplementary measure, was not determined.

BACK (E. A.) & COTTON (R. T.). **Hydrocyanic Acid Gas as a Fumigant for destroying Household Insects.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 1670, 20 pp., 20 figs. Washington, D.C., April 1932.

For fumigating buildings, hydrocyanic acid gas has advantages possessed by no other fumigant. It can be used without fear of fire

and without disarranging the house furnishings, and can be removed from buildings in a very short time. It is cheap, and its lethal effect is so rapid that it can be used in poorly constructed houses where other fumigants would escape before they have time to have any effect. Since it is lighter than air, it escapes upwards when windows and doors are opened, or through cracks in the buildings, and does not settle in the form of a dangerous blanket of vapour near the surface of the ground.

Details are given of the technique of fumigating buildings, including the methods of generating the gas. Notes on precautionary measures and instructions for treatment of persons overcome by the fumes are included.

Groves (A. B.). **A Photographic Light Box for Use in Agricultural Research.**—*J. Agric. Res.*, xliv, no. 5, pp. 467–475, 2 pls., 3 figs. Washington, D.C., 1st March 1932.

The following is taken from the author's summary: The light box described has proved very satisfactory as a source of illumination for photographing diseased fruits and similar specimens. It provides a simple and inexpensive means by which shadows, high lights and cross lights can be eliminated and at the same time enables the operator to secure the colour of background that is best suited for the object photographed. Since the light comes entirely from artificial sources, it is always uniform. This makes photographic work possible at any time of day or night, and so long as other factors are constant, the period of exposure for best results will not vary appreciably.

In addition to being of use in ordinary indoor photography, the box may be used for making lantern slides and in low-power photomicrographic work. The construction of the box, together with its method of operation, is described in detail.

Mills (H. B.). **Springtails as Economic Insects.**—*Proc. Iowa Acad. Sci.*, xxxvii, pp. 389–392, 11 refs. Des Moines, 1930. [Recd. June 1932.]

The literature on Collembola as injurious or useful insects is briefly reviewed, and a list of the species of economic importance is given, with their food-plants.

Gould (E.). **The Pistol-case Bearer.**—*Bull. W. Virginia Agric. Expt. Sta.*, no. 246, 12 pp., 10 figs., 4 refs. Morgantown, W. Va., December 1931. [Recd. June 1932.]

An account is given of observations on the bionomics and control of *Coleophora* (*Haloptilia*) *malivorella*, Riley, in West Virginia, conducted during 1929 [*R.A.E.*, A, xviii, 403]. In addition to apple, which is the favourite food-plant, pear, quince and wild cherry are also attacked. Winter mortality is probably not high; birds were observed destroying cocoons, but their importance was not determined. Parasites reared from cocoons collected in the field were *Hyposoter annulipes*, Cress., *Hemiteles gracilariae*, Ashm., *H. tenellus*, Say, *Microbracon pygmaeus*, Prov., *Meteorus vulgaris*, Cress., *Microdus* (*Bassus*) *coleophorae*, Rohw., *Dibrachys* (*Coelopisthia*) *hemerocampae*, Gir., and apparently undescribed species of *Macrocentrus*, *Rhoptrocerus*, *Monodontomerus* and

Habrocytus, the last-named appearing to be the most important. *Monodontomerus* is considered to be probably a hyperparasite, and species of *Rhoptrocerus* are not usually parasitic on Lepidoptera.

FINK (D. E.). **Biology and Habits of the Strawberry Leaf Roller, *Ancylis comptana* (Froel.) in New Jersey.**—*J. Agric. Res.*, xliv, no. 7, pp. 541–558, 9 figs., 11 refs. Washington, D.C., 1st April 1932.

As a result of a severe outbreak of *Ancylis comptana*, Froel. (strawberry leaf-roller) in New Jersey during 1920, investigations were undertaken on its bionomics.

The following is largely taken from the author's summary: The larvae of this moth feed on the foliage of strawberry, raspberry and blackberry, and it may become established in widely separated localities through the transport and setting out of infested plants. Fertilised females lay 20–120 eggs, which hatch in 5–17 days. They are usually deposited on the lower surface of the leaves, on which the young larvae subsequently feed, protected by silken shelters. Later they migrate to the upper surface and roll or fold the leaves, within which they feed and pupate. For the two summer generations the egg stage occupies an average of 7 days and the prepupal period 2–3, the total life-cycle of the first averaging 51 and that of the second 38. For the hibernating generation, the larval period occupies an average of 178 days, including a prepupal hibernation period of about 142, and the total life-cycle 198. The pupal stage lasts 6–13 days. An increase in the accumulation of adipose tissue and a reduction of the water content occurs in larvae about to enter hibernation.

Experiments indicate that when hibernating larvae are subjected to a temperature of 24°C. [75·2°F.] or 31°C. [87·8°F.] and after four days or more placed at a temperature of 10°C. [50°F.] for a considerable time, a high mortality results, but that if they are first kept at 10°C. for a considerable period and then subjected to the higher temperature, pupation occurs and the mortality is very low. The limits of pupal development are between 15°C. [59°F.] and 34°C. [93·2°F.] with an optimum of 27°C. [80·6° F.]–34°C.

In addition to some of those previously recorded [*R.A.E.*, A, xiii, 514], the following parasites were reared: *Spilocryptus exannulatus*, Cush., *Perisierola* sp., *Dibrachys meteori*, Gahan, *D. aeneoviridis*, Gir., *Habrocytus* sp., *Spilochalcis* sp. and *Pimpla* (*Epiurus*) *indigator*, Walsh.

STREETER (L. R.), CHAPMAN (P. J.), HARMAN (S. W.) & PEARCE (G. W.). **Spray and other Deposits on Fruit.**—*Bull. N.Y. St. Agric. Expt. Sta.*, no. 611, 19 pp., 5 figs., 3 refs. Geneva, N.Y., April 1932.

An account is given of the problem of spray and other residues on fruit in New York, and the results of experiments in methods of cleaning fruit are presented to provide a record of the situation under local conditions. Some arsenical residues in excess of tolerance have been reported during 1930 and 1931 where heavy and late spraying has been necessary on apples. About 40 per cent. of the residue is found in the stem and calyx ends of the fruit. Residues other than those of arsenical sprays frequently encountered include sulphur fungicides, specking by leafhoppers (principally *Typhlocyba pomaria*, McAtee),

sooty mould associated with *Aphis pomi*, DeG., on apples and *Psylla pyricola*, Först., on pears, and road dust.

Mechanical dry cleaners are suitable for removal of light or moderate residues and give the fruit a clean polished appearance, but the washing method is more dependable for heavy residues. Washing machines equipped with polishing units are satisfactory for the removal of all types of residues and improve the appearance of the fruit. A washing solution of hydrochloric acid, 1–3 per cent. by volume, is generally adequate for the removal of arsenical residues under New York conditions. The best time to clean apples is directly after picking and before heavy wax formation takes place. The keeping quality of the apples showed no material alteration after the cleaning operation.

Some evidence has been reported indicating that the addition of hydrated lime to summer sprays facilitates the removal of arsenical residues. Samples of fruit taken 2 months after the application of lead arsenate at the rate of 3 lb. to 100 U.S. gals. water showed a residue of 0·047 grains per lb. where no hydrated lime had been added, as compared with 0·032 and 0·024 grains respectively where 10 lb. and 40 lb. had been added. Whether the arsenic is taken off mechanically by weathering, or by reaction between the lime and lead arsenate forming soluble calcium arsenates, which are washed off in their turn, is unknown. Calcium arsenate has been shown to be much less adhesive than lead arsenate, but its use is not generally recommended on apples on account of foliage injury.

Knowlton (G. F.). **The Beet Leafhopper in Northern Utah.**—*Bull. Utah Agric. Expt. Sta.*, no. 234, 64 pp., 16 figs., 233 refs. Logan, Utah, May 1932.

Investigations on the ecology of *Eutettix tenella*, Baker (beet leafhopper) were begun in northern Utah in 1925, being carried out on the same lines as those in Idaho [*R.A.E.*, A, xix, 263]. The work included a study of its breeding grounds, food-plant relationships, seasonal abundance and time of migration, the effect of parasites and predators, and the damage it causes to the beet crops, and the data obtained are discussed in detail.

Examinations carried out from 1929 to 1931 on the amount of parasitism indicated that it was in no case high and usually fluctuated from year to year in a given area; it was generally lower in the beet-growing areas than in the majority of desert breeding grounds. In most parts of the State the nymphs and adults are parasitised by the larvae of *Pipunculus* spp. (chiefly *P. subvirescens*, Lw.), particularly during the latter part of the summer; various Dryinids were fairly common, though the rate of parasitism was in no case high. The eggs were attacked by *Polynema eutettixi*, Gir., and *Aphelinoidea plutella*, Gir. *Geocoris decoratus*, Uhl., is predacious on the leafhoppers, becoming active early in the spring, and is probably an important factor in reducing the numbers of overwintering individuals in the breeding grounds. *Nabis ferus*, L., is a voracious feeder on *E. tenella*, but though more efficient for a given number of individuals, it was less abundant in the breeding grounds than *G. decoratus*. It also attacks *Empoasca filamenta*, De Long, a common pest of potatoes and beans in Utah. Single instances of attack by *Zelus socius*, Uhl., and *Lygus pratensis*, L., which latter is not ordinarily considered predacious, were observed. Spiders and lizards are important predators.

Fife (J. M.). **A Method of artificially feeding the Sugar-beet Leafhopper.**—*Science*, lxxv, no. 1948, pp. 465–466, 2 figs., 2 refs. New York, 29th April 1932.

Two devices for artificially feeding *Eutettix tenella*, Baker, on liquids in biochemical investigations are described. In each the insects feed through paraffin membrane (a section of paraffin ribbon cut with a microtome), as the animal mesentery membranes used in other work [*R.A.E.*, A, xvi, 70] affect pH determinations. In one device the leafhopper is confined in a glass tube with the membrane at the top; in the other it is on its side in a compartment between two cover glasses so that feeding can be observed with a microscope.

Thomas (C. A.). **The Diseases of Elateridae (Coleoptera).**—*Ent. News*, xliii, no. 6, pp. 149–155, 1 fig., 26 refs. Philadelphia, Pa., June 1932.

In continuation of his previous work [*R.A.E.*, A, xviii, 112; xix, 474], the author gives a summarised account of the bacteria and fungi attacking Elaterids. The diseases, particularly those of the larvae, are widespread, but infected individuals are rarely found in the field owing to their subterranean habit, the rapid progress of the disease under favourable conditions and the practically complete disintegration of the insect's body. In the laboratory, however, disease often spreads rapidly, destroying whole batches of wireworms in a short time. A complete study of the conditions that favour the successful transfer, inoculation and growth of these diseases would be necessary before it would be possible to make any recommendations for their artificial dissemination in the field.

Glaser (R. W.). **Studies of *Neoaplectana glaseri*, a Nematode Parasite of the Japanese Beetle (*Popillia japonica*).**—*Circ. New Jersey Dept. Agric.*, no. 211, 34 pp., 3 pls., 20 refs. Trenton, N.J., April 1932.

The following is largely taken from the author's summary:—*Neoaplectana glaseri*, Steiner, a Nematode attacking *Popillia japonica*, Newm., in New Jersey, was first discovered in 1929 [*R.A.E.*, A, xviii, 112] and is apparently specific to the beetle. Four stages of this Nematode occur, the first, second, pre-adult and adult. By confining larvae of the beetle in soil containing second stage Nematodes, with or without other stages, a mortality of 70 per cent. was obtained, the average period from infestation to death being 11·3 days. The results indicate that the second stage is the invasive form, and no infestation was obtained with first stage ones or adults. The Nematodes infest their host by way of the mouth, develop 2–3 generations within its body, and finally destroy it by feeding on the tissues, development continuing until most of the tissues have been consumed. In dying and newly dead individuals, all stages of the Nematode are to be found; in those that have been dead some time the second stage or free-living form predominates. *Neoaplectana* has been reared throughout its entire life-cycle upon an artificial medium [*cf.* xx, 125]. A generation develops every 4–5 days, but after a time the Nematodes lose their ability to reproduce upon the artificial medium. This loss is, however, regained after a number of passages through the beetle larvae (one often proving insufficient). Most of the parasite larvae are born while

the female is still alive, 15 being the average number produced by one female, and the sexes are about equal. Cultivation does not alter the pathogenicity of the Nematodes for *P. japonica*. Preliminary field experiments indicate that they can be established in localities where they do not occur naturally and, when so established, produce a high mortality.

Ogloblin (A. A.). **Segundo informe sobre un nuevo parásito del trigo (*Prosaldius rufus*, Hust.).** [Second Report on a new Pest of Wheat, *P. rufus*.]—*Bol. Minist. Agric. Nac.*, xxx, no. 4, pp. 207–213, 6 pls. Buenos Aires, 1931. [Recd. June 1932.]

A preliminary account of the infestation of wheat in Argentina by the larva of a weevil has already been noticed [*R.A.E.*, A, xix, 498]. It is now confirmed that the species concerned is one that Hustache intends to describe as *Prosaldius* [not *Prosalidus* as originally written in error] *rufus*. Its native food-plant is *Bromus unioloides*, which is distributed throughout the Republic, and infestation of wheat is occasional, occurring when *B. unioloides* is scarce. Descriptions are given of oviposition as observed in November 1930 and of the larval mines in *B. unioloides* and wheat. No serious injury to wheat has been observed. Some morphological details of the adult are figured, but not described.

Monte (O.). **Uma broca do kaki, *Neoclytus pusillus*, Cast. & Gory.** [*N. pusillus*, a Borer of Persimmon.]—*Chacaras e Quintaes*, xlv, no 5, pp. 579–580, 1 fig. S. Paulo, 15th May 1932.

The Cerambycid, *Neoclytus pusillus*, Cast. & Gory, is recorded as boring in the trunks of persimmon (*Diospyrus kaki*) in the State of Minas, Brazil, and the usual measures against such borers are suggested.

Palo (M. A.). **Anthracnose and important Insect Pests of the Mango in the Philippines, with a Report on Blossom-spraying Experiments.** —*Philipp. J. Sci.*, xlviii, no. 2, pp. 209–235, 8 pls., 6 refs. Manila, June 1932.

The Jassids, *Idiocerus clypealis*, Leth., and *I. niveosparsus*, Leth., and the Noctuid tip-borer, *Chlumetia transversa*, Wlk., play an important part in affecting the production of the mango crop in the Philippines. Of the Jassids, which are the chief insect pests of the crop, *I. clypealis* is the more numerous. Some of the information on their habits and the injury they cause is similar to that already noticed [*R.A.E.*, A, xviii, 444]. Egg-laying begins on the inflorescences after the buds have appeared and the panicles have grown out to a certain length. During 1931, two or more broods occurred before the opening of the flowers, and one or two more during the blossoming period. The honey dew exuded by these insects may serve as a medium for development of the sooty mould, *Chaetothyrium mangiferae*, which sometimes persists until the fruits mature. When the flowers have disappeared, the hoppers migrate to the foliage, where feeding and egg-laying continue. In May the adults, particularly those of *I. clypealis*, occurred in large numbers on the leaves. During July–October although their numbers decreased, they were still quite abundant. Egg punctures were again observed during the latter part of September, on the leaves and tender stems, when most of the hoppers present were probably *I. niveosparsus*.

Chlumetia transversa, which is widely distributed throughout the central and southern provinces of Luzon, damaged about 25 per cent. of the inflorescences in one locality. The injury is caused by the larvae that enter near the developing panicles and then tunnel into the central part, thus causing the spikes and spikelets to shrivel and dry. They also attack the young shoots of the new flushes, causing the death of the top parts and a reduction of the flowering area in the succeeding blooming period.

Experiments with two series of sprays applied to trees slightly attacked by anthracnose and infested by *Idiocerus* and *Chlumetia* are discussed in detail. In the first series Bordeaux mixture containing lead arsenate powder at the rate of 1·5 lb. to 50 U.S. gals. was applied when the inflorescence buds were bursting. A second spray of Bordeaux mixture containing nicotine sulphate, 1 : 800, and 0·8 lb. lead arsenate to 50 U.S. gals. was applied before the flowers opened. This was followed by two thorough sprayings with nicotine sulphate and soap at an interval of 3–6 days. The last spray, which was a repetition of the second, was applied when the petals were withering. In the second series lime-sulphur was substituted for Bordeaux mixture, and was used instead of soap with the third spray, the fourth being omitted and the spray times slightly altered. Since it had been previously found that weekly applications were of little value in controlling the hoppers, the nicotine sulphate sprays were applied when new broods were observed to be hatching. The results of these tests did not definitely prove that the numbers of tip-borers had been reduced by the lead arsenate, but the nicotine sulphate in both series proved effective in reducing damage by the hoppers.

KRUGER (G.). **Cirenaica : Plant Pests.**—*Int. Rev. Agric.*, xxiii, no. 4, pp. M53–54. Rome, April 1932.

The larvae of *Earias chlorana*, L., and *E. insulana* ab. *anthophilana*, Snell., have destroyed numerous cotton bolls growing in experimental plantings in Cyrenaica, and *Platyedra gossypiella*, Saund., which is new to the region, was reared by the author from some of the bolls. In one locality on the coast, larvae of the Geometrid, *Acidalia fulminataria*, Turati, were observed on the flowers of carnation (*Dianthus caryophyllus*). Applications of a weak spray of Urania green, continued until the foliage became brown, were very effective against *Phycita poteriella*, Zell., and *P. fuscopilella*, Chrét., on castor [*Ricinus communis*].

WIDIEZ (M.). **La culture du figuier en Afrique du Nord.**—*Agric. prat. Pays chauds*, no. 24, pp. 415–445, numerous refs. Paris, June 1932.

This general account of the cultivation of figs in Algeria includes a section (pp. 438–444) dealing with their insect enemies. *Ceroplastes rusci*, L., the principal Coccid attacking figs, sometimes covers leaves, branches and trunk, and is particularly abundant among trees planted too closely together. Little harm is done to carefully cultivated and well spaced trees. Infested branches rapidly become yellow and the leaves drop, the fruit remaining small and stunted and acquiring an unpleasant taste. Insecticides are not effective against this well-protected insect, but it is destroyed by the Noctuid, *Eublemma* (*Erastria*) *scitula*, Ramb., and the Pteromalid, *Scutellista cyanea*, Motsch., which usually prevent the attack from becoming sufficiently

serious to kill the trees. Soaking in boiling salted water will remove all trace of the Coccids from fruit that is thickly covered with them. Other scale insects attacking fig include : *Lepidosaphes ficus*, Sign. (*Mytilaspis conchiformis*, Gmel.), which is parasitised by *Aphelinus mytilaspidis*, LeB., and *L.* (*M.*) *minima*, Newst., which is less prevalent. Although *Morganella longispina*, Morg., has occasionally occurred in Algeria, it has always been eliminated, and precautions should be taken against its establishment there, as it is liable to cause heavy damage. It may be controlled by cutting off and burning infested branches. The females of the Scolytid, *Hypoborus ficus*, Er., lay 25–30 eggs in a groove that they hollow out of the bark of the tree, and the larvae tunnel in the bark, in which they pupate. In Algeria, except in regions where the winters are cold, the generations are continuous, there being at least 4 in a year. The attack is limited almost entirely to trees already weakened from other causes and is concentrated on the young branches, which wither. *H. ficus* is parasitised by the Braconid, *Sycosoter lavagnei*, Pic. & Licht. [*R.A.E.*, A, xv, 488], which lays its eggs in the host larvae. Other beetles attacking figs include the Scolytid, *Hypothenemus ehlersi*, Eichh., the Lamiid, *Niphona picticornis*, Muls., and the Cerambycids, *Hesperophanes sericeus*, F., *H. cinereus*, Vill., and *H. griseus*, F., the larvae of all of which tunnel in the branches causing varying degrees of injury ; the only method of control is the burning of the infested wood.

The fruit is attacked in the course of drying and storage by *Myelois ceratoniae*, Zell., which also occasionally infests 5 per cent. of the fruit on the tree, and *Ephestia kühniella*, Zell., the eggs being laid on the surface of the figs during the night. The larvae enter the fruit on hatching, *M. ceratoniae* pupating within it, and *E. kühniella* emerging for pupation. Preventive measures include the use of fine mesh screens over all apertures at night, to prevent the moths from entering the storerooms, and careful fumigation or disinfection and cleaning of the latter before figs are placed in them. As *M. ceratoniae* also attacks carobs [*Ceratonia siliqua*], these should not be stored in proximity to figs.

In addition to the caprified varieties, which are the only ones the fruit of which is used for drying, other varieties of figs are grown in Algeria, and these produce two series of edible fruits, neither of which requires caprification by *Blastophaga psenes*, L. The first series matures in one season, but the second does not do so until the following year. A desirable precaution, which should be made compulsory, as it is already in Turkey, is the consumption or destruction of the fruits of the second series, and of the early ripening ones of the caprified varieties ; such fruits, if allowed to drop, serve to harbour moths and other insects liable to attack the crop on the trees or in the course of drying. Stored figs may be packed in some material such as cellophane that will prevent the access of moths, and insects infesting them when harvested may be destroyed by plunging them into hot salt solution (4 per cent.) and the use of sulphur.

BISHARA (I.). **The Greasy Cutworm** (*Agrotis ypsilon* **Rott.) in Egypt.**— *Bull. Minist. Agric. Egypt*, no. 114, 55 pp., 6 pls., 14 diag. Cairo, 1932.

An account is given, supplemented throughout by references to the literature, of observations on all aspects of the bionomics and control of *Agrotis ypsilon*, Hfn., in Egypt. All stages of the moth are described, and its economic status and distribution throughout the world are

briefly indicated. Although injury is reported each season in Egypt, it is only every 4–5 years that it is serious. Damage usually occurs at two definite periods of the year, to winter crops, chiefly wheat and berseem [*Trifolium alexandrinum*], during November-December, and to summer crops, chiefly cotton, during March-April. Clay soils appear to have a decided attraction and suffer the severest injury. Light loamy soils are less severely infested, and sandy ones hardly at all. A very severe attack, however, with as many as 25 larvae to the square yard, occurred in one instance on crops grown on a light soil. In the Nile basin, seed is either broadcast on the mud immediately the floods have receded, or the land is ploughed when sufficiently dry (usually 2–3 weeks after the water has receded) prior to sowing. Crops sown according to the first method in most cases escape attack by the cutworm, whereas those sown on ploughed areas may be destroyed altogether. Records of infestations during a period of 8 years show that most of the outbreaks occurred at a mean maximum temperature of about 24–28°C. [75·2–82·4°F.] ; above 32°C. [89·6°F.] records of infestation are few, and before 36°C. [96·8°F.] is reached they cease completely. Experiments to determine the relation between temperature and development of *A. ypsilon*, as well as observations on its distribution and abundance and the migratory habits of the adults, are discussed in detail. A considerable amount of evidence has been obtained that the absence of damage to crops in summer is due to migration of the moths from cultivated areas in spring, and that the factor concerned is temperature [*cf. R.A.E.*, A, xiii, 610].

Parasites, which are discussed in some detail, are of considerable value in holding the cutworm in check, particularly in the spring. *Apanteles ruficrus*, Hal., which is widely distributed throughout the country, is probably the most important. It produces 6 generations to 3 of its host, and the rate of parasitism by it rises from 1 per cent. in the winter to 15–16 in March and 27–34 in April. The Tachinid, *Gonia capitata*, DeG., is also an important and widely distributed parasite of the larvae. The eggs are laid on the foliage and are ingested by the host larvae. Pupation generally takes place within the pupa of the host, the adults emerging 13–19 days after the latter pupates. Only one matures on each host. Maximum parasitism was observed during April when 26 individuals emerged from 46 pupae of *Agrotis*. *Microplitis* sp. is abundant locally. Of 75 larvae of *A. ypsilon*, about a week old, that were confined with it, 52 per cent. were found to be parasitised, but newly hatched larvae were not attacked. *Meteorus laeviventris*, Wsm., was reared from larvae collected on cotton and berseem, and 3 individuals of *Eulimneria xanthostoma*, Grav., were reared from 117 larvae taken on cotton.

Various control measures recommended include the destruction of weeds, since they attract the ovipositing females, hand-picking and flooding. In the last instance some of the larvae rise to the surface of the water, where they are destroyed by birds and other natural enemies, and the others are drowned. Flooding for 24 hours kills all the larvae, but divergent views exist as to possible injury to young cotton by this procedure. In Egypt poison-baits have been used with varying degrees of success ; bran baits do not appear to be more attractive than the crops on which the larvae feed. Andres-Maire traps [*cf.* ix, 76] are considered of little value, since though they capture large numbers of moths, the catch represents only a small percentage of those present in the fields.

Kryger (I. P.). **One new Genus and Species, and three new Species of Trichogramminae from Egypt with Remarks upon** *Neocentrobia hirticornis*, *Alaptus minimus*, **and** *Trichogramma evanescens*.—*Bull. Soc. roy. ent. Egypte*, xvi, fasc. 1–2, pp. 38–44, 21 figs. Cairo, 1932.

The Chalcidoids described from Egypt include *Sethosiella priesneri*, gen. et sp. n., which was bred, together with the Mymarid, *Alaptus minimus*, Wlk., from vine leaves infested with *Retithrips syriacus*, Mayet. As European species of *Alaptus* are parasites of Psocid eggs, it is possible that *A. minimus*, and even *Sethosiella*, may have emerged from the eggs of Psocids accidentally occurring on the vine leaves, and not from those of the thrips.

Frappa (C.). **Sur** *Dactylopius tomentosus* **Lam. et son acclimatement à Madagascar.**—*Rev. Path. vég. Ent. agric.*, xix, no. 2, pp. 48–55, 1 pl., 1 fig., 11 refs. Paris, February 1932.

The author has examined specimens of *Dactylopius* collected from many parts of Madagascar between 1928 and 1931 on the chief species of *Opuntia* occurring in the Island and has identified them all as *D. opuntiae*, Ckll. (*tomentosus*, auct.), of which he describes the principal characters. He has not been able to examine any individuals from the south of the Island, but has every reason to believe that the Coccid destroying *Opuntia* there also belongs to this species.

Harukawa (C.) & Kumashiro (S.). **On the Pear-bark Miner,** *Acrocercops astaurota* **Meyrick. II.**—*Ber. Ōhara Inst. landw. Forsch.*, v, no. 2, pp. 301–310, 1 ref. Kuraschiki, 1932.

Details are given of the seasonal occurrence in 1930 near Kurashiki of the Tineid, *Acrocercops astaurota*, Meyr., which attacks pear, etc. [*R.A.E.*, A, xix, 162]. In the laboratory the minimum temperature at which the eggs developed was 12°C. [53·6°F.], the egg-stage lasting 30 days at this temperature, 15 at 20°C. [68°F.], 9 at 25°C. [77°F.], and 6 at 30°C. [86°F.]. At 33°C. [91·4°F.] the eggs developed rapidly, but the larvae failed to hatch. In Kurashiki temperatures as high as 33–34°C. occur out-of-doors for only a few hours on very hot summer days, and the eggs are probably not affected. The minimum temperature for the growth of the larvae was also about 12°C., and in the field the overwintering larvae ceased to feed when the maximum day temperature was lower than this. In the laboratory, the larvae apparently continued to develop at a constant temperature of 35°C. [95°F.], but could not be reared owing to deterioration of the food-plant under these conditions. The minimum temperature for pupal development was slightly above 12°C. ; at 20 and 25°C. the pupal period lasted 25 and 14 days respectively, and at 35°C. no adults emerged.

The food-plants of *A. astaurota* are discussed [*cf. loc. cit.*]. Observations in which small fruit trees or cut shoots were exposed to the moths showed that apple was preferred to pear for oviposition, and there is evidence that in localities in Japan where apples are abundant, they are severely infested.

Experiments with various sprays are described, and one of nicotine sulphate, 1 : 1,000, with 3 lb. of soap per 100 gals., is recommended as an ovicide. In the experiments this spray destroyed all the eggs. Three thorough applications should be applied at weekly intervals,

timed according to the flight of the moths. If the larvae are numerous, a spray of 1 part pyrethrum emulsion and 19 parts water should be applied about 1st August, when those of the first generation are in the last stage of mining, and repeated two or three times at intervals of about 10 days. In field experiments this spray killed 80–90 per cent. of the larvae. The stock emulsion is prepared from pyrethrum powder extracted with a mixture of kerosene and petrol, the formula being 75 gm. pyrethrum powder, 0·9 litre kerosene, 0·9 litre petrol, 56 gm. soap and 0·9 litre water. The pupae proved to be very resistant to sprays.

HARUKAWA (C.). **On the toxic Action of Hanahiri-no-ki and its Application for the Control of Yuri-mimizu.**—*Ber. Ōhara Inst. landw. Forsch.*, v, no. 2, pp. 311–322, 1 graph, 1 ref. Kuraschiki, 1932.

In the course of studies in Japan on the effectiveness of the leaves of *Leucothoe grayana* for use in various ways against aquatic oligochaetes in rice-fields, tests were also made of the possible insecticidal properties of this plant. In these experiments, the results of which are shown in a table, extracts of dried leaves prepared with different solvents were sprayed on larvae of various insects. Some of the samples seemed to be fairly toxic to those of *Phaedon brassicae*, Baly, 50–80 per cent. being killed, but in most cases they were not effective enough to be promising as insecticides.

DELLA BEFFA (G.). **I parassiti animali delle piante coltivate od utili. Vol. I.** [The animal Pests of cultivated or useful Plants. Vol. I.] —Med. 8vo, xvi + 346 pp., 345 figs. Milan, U. Hoepli, 1931. Price *Lire* 28. [Recd. July 1932.]

This volume of a text-book for agricultural schools is the first of those on insect pests of cultivated plants, forest trees and stored products in Italy. It opens with a general section giving a brief account of the morphology and senses of insects, the injury they do, the natural factors limiting their abundance, the different methods of artificial control, and a key to the various orders. The remaining 297 pages are devoted to the injurious Coleoptera, arranged by families. A brief account is given of the appearance, bionomics and control of the different species, the space allotted to each varying with its importance.

VANCE (A. M.). **The Biology and Morphology of the Braconid *Chelonus annulipes* Wesm., a Parasite of the European Corn Borer.**—*Tech. Bull. U.S. Dept. Agric.*, no. 294, 48 pp., 1 pl., 12 figs., 17 refs. Washington, D.C., May 1932.

Chelonus annulipes, Wesm., which was first discovered as a solitary parasite of *Pyrausta nubilalis*, Hb., in maize at Piacenza, Italy, in 1925 and has been recorded as *C. inanitus*, L. [*R.A.E.*, A, xvii, 726], has recently been found to be of economic importance in two restricted areas in Venetia. In these districts parasitism of the first generation of *P. nubilalis* in 1929 averaged 16·9 and 8 per cent. respectively, with a maximum of 28·6 per cent. in one maize field in the first centre, where parasitism of the second generation averaged 3·5 per cent. This Braconid appears to occur over most of northern Italy as a parasite of *P. nubilalis*. All stages are fully described. Observations

of the life-history carried out at Hyères, France, during 1930, which are described in detail, show that the female deposits an egg in that of the host, the larva developing within the growing borer. During its third stage it emerges from the fourth instar host larva, devours all the remaining contents of the latter, spins a cocoon and pupates.

At a constant temperature of 77°F., the egg, larval and pupal stages average 2, 20 and 9½ days. Higher or lower temperatures shorten or lengthen development of all stages, and under field conditions it is probable that the life-cycle from egg to adult covers about 40 days. In the laboratory the female, whether mated or not, starts oviposition soon after emergence, unmated females reproducing parthenogenetically and their progeny being males. Both male and female adults, when given food and water and kept at temperatures varying between 46°F. and 77°F., will live for some time, one female living 84 days under these conditions.

In northern Italy *C. annulipes*, like its host, has two generations annually. It overwinters as a late first-stage larva within the fourth instar larva of the host and in early May resumes development. Pupation and emergence follow toward the middle and end of the month, and in early June a considerable number of adults are ready to attack the first generation of *P. nubilalis* already present on young maize plants. The larvae issue from the host and spin their cocoons in the middle of July, and during the last week of that month and the early part of August the adults emerge and begin to oviposit in the host eggs of the second generation. Both host and parasite of this generation, after a certain amount of growth, enter a dormant condition for the winter months about the middle of September.

C. annulipes was first imported into the United States in the summer of 1929, and during 1929 and 1930 a total of 10,767 individuals were shipped from Italy. This parasite is most easily procured during the winter months when hibernating within the host larvae.

A total of 8·8 per cent. of 232 cocoons of *C. annulipes* collected in Italy in 1929 and 2·1 per cent. of 1,432 cocoons received from Italy the same year produced hyperparasites. Those reared included *Pimpla* (*Exeristes*) *roborator*, F., *Eupteromalus* sp., and *Habrocytus* (*Hypopteromalus*) *poecilopus*, Crwf.

Rui (D. B.). **Lotta invernale contro la Tignola del Melo** (*Hyponomeuta malinellus*). [Winter Work against the Apple Moth.]—*Note Fruttic.*, x, no. 6, pp. 96–105, 3 figs. Pistoia, June 1932.

The biology of *Hyponomeuta malinellus*, Zell., on apple is briefly described, and a detailed account is given of experiments in November and December in Venetia to ascertain if winter spraying against the larvae under the protective shields of the eggs is practicable. A proprietary insecticide containing 85 per cent. of aromatics and paraffin hydrocarbons and 15 per cent. of solvents was used at a concentration of 7 per cent., but the results obtained did not justify the cost.

Mayné (R.) & Van den Bruel (W.). **La question de la mouche de la betterave en Belgique** (*Pegomyia hyoscyami* **var.** *betae*, **Curt.**).—*Bull. Inst. agron. Sta. Rech. Gembloux*, i, no. 1, pp. 46–64, 5 figs., 3 refs. Gembloux, February 1932. [Recd. June 1932.]

This review of the situation in regard to infestation of beet by *Pegomyia hyoscyami* var. *betae*, Curt., in Belgium in 1931 includes a

more detailed account of experiments already noticed [*R.A.E.*, A, xx, 340]. The period of greatest general activity of the fly was in June, with local recrudescences in July and September. Larvae collected from various parts of the country and bred in the laboratory showed only a very slight degree of parasitism. The average loss in infested fields amounted to about $2\frac{3}{4}$ tons of roots to the acre.

MAYNÉ (R.). **Note sur la stérilisation du sol à la chaux vive.**—*Bull. Inst. agron. Sta. Rech. Gembloux*, i, no. 2, pp. 99–105. Gembloux, May 1932.

The control of a great number of insect pests may be best effected by the destruction of small foci during a period of low activity. When such foci are situated below the surface of the ground and the insects in them show great resistance to insecticides, as in the case of Dipterous pupae, the mixture of quick-lime with the infested earth constitutes an excellent method of control. Preliminary tests have indicated that the best method of application is to remove the earth with a spade and mix it into a heap with the quick-lime in the proportion of 1 part of lime to 4 parts of earth, wetting it abundantly during the operation. The temperature will soon rise to 100°C. [212°F.] or more, at which all living organisms are rapidly killed. If poor lime is used the mixture should be made in equal parts. Lime is particularly recommended for destroying small foci of hibernating pupae of *Rhagoletis cerasi*, L. The effect of this treatment may be enhanced by the destruction of any ripening cherries remaining over after harvest and liable to harbour larvae.

VAN POETEREN (N.). **Bestrijding van de Narcisvliegen.** [Control of the Narcissus Bulb Flies.]—*Tijdschr. Plantenz.*, xxxviii, no. 5–6, pp. 73–77. Wageningen, 1932.

A notice, dated April 1932, has been published in Holland, drawing attention to the need for destroying *Merodon equestris*, F., and *Eumerus tuberculatus*, Rond., by burying all infested narcissus bulbs and soil with quick-lime. Against the adult flies the sodium fluoride bait-spray found effective in England [*R.A.E.*, A, xix, 374] is recommended.

WENZEL (G.). **Massenauftreten der Nonne (*Lymantria monacha* L.) in der Nähe Magdeburgs.** [Outbreak of *L. monacha* near Magdeburg.]—*Ent. Z.*, xlvi, no. 4, pp. 39–40. Frankfurt a. M., 22nd May 1932.

An outbreak in a small isolated pine wood near Magdeburg of *Lymantria monacha*, L., which was thought to have completely disappeared from this district, was observed in 1931.

RAMBOUSEK (F.). **Schädlinge und Krankheiten der Zuckerrübe im Jahre 1930.** [Pests and Diseases of the Sugar-beet in Czechoslovakia in 1930.]—*Z. Zuckerind. čsl. Repub.*, 1930–31, pp. 539–551, 8 figs.; also in *Ber. ForschInst. čsl. Zuckerind. Prag*, xxxv, pp. 59–71, 8 figs. Prague, 1932.

As a result of the unusually mild winter of 1929–30 and dry weather that hindered the development of entomogenous fungi, beet pests were numerous in various parts of Czechoslovakia in the spring and

summer of 1930. *Pegomyia hyoscyami* var. *betae*, Curt., was the most important. The first flies appeared very early in the spring and were compelled to oviposit on weeds and spinach, but beet was severely attacked at a later date. Though parasites brought this outbreak to an end in the second half of June, the larvae began to increase again in August, enormous numbers occurring in September and October, when cold weather and rain checked the development of their parasites. The bug, *Anthocoris nemorum*, L., which has not previously been recorded as an enemy of *Pegomyia*, was found attacking its eggs. The control of the fly before oviposition occurs is of special importance if the months of May and June are cold and wet; when the temperature does not fall below 17°C. [62·6°F.], parasites will be able to keep it in check. An outbreak of the Cryptophagid, *Atomaria linearis*, Steph., occurred on germinating beet, and though it was brought to an end by cold towards the end of May, in many districts the plants had to be ploughed under. Immature beetles were numerous in soil samples in the autumn, indicating that the larvae develop between June and the end of August. In captivity the females lived about three months, and the males about two.

Wireworms were serious pests throughout the country, 70–80 per cent. being *Agriotes ustulatus*, Schall., which in some localities was accompanied by *Athous bicolor*, Goeze (*longicollis*, Ol.). They are best controlled by collecting the adults and letting poultry clear the larvae from the fields, as chemicals and artificial manures, such as Kainit, injure the plants in dry weather. Flea-beetles (*Haltica* spp.) and Lamellicorn larvae caused serious damage in many localities. Of the weevils, which were very abundant, *Otiorrhynchus ligustici*, L., occurred more often than *Bothynoderes punctiventris*, Germ., and *Tanymecus palliatus*, F., was recorded from one locality only. *Euxoa* (*Agrotis*) *segetum*, Schiff., was a serious pest in Slovakia. *Bibio hortulanus*, L., was abundant in a few districts only and for a short time. The Jassid, *Empoasca* (*Chlorita*) *flavescens*, F., occurred in greater numbers than in the preceding year, and in one instance in the autumn the infection of beet leaves with what appeared to be mosaic disease by this insect was observed. *Aphis fabae*, Scop., was common in many localities and caused considerable injury, as did the Silphid beetles, *Blitophaga opaca*, L., *B. undata*, Müll., and *Silpha obscura*, L.

Cassida nebulosa, L., and *C. nobilis*, L., were not numerous, as owing to the thinness of the snow-cover during the mild winter the hibernating adults were exposed to birds. Other minor pests included Smynthurids, mole-crickets [*Gryllotalpa*], *Lygus campestris*, Fall., *Scotogramma* (*Mamestra*) *trifolii*, Rott., and *Phytometra* (*Plusia*) *gamma*, L. It is stated that the record of *Amblyteles vadatorius*, Ill., as a parasite of *P. gamma* in 1929 [*R.A.E.*, A, xix, 590] was due to misidentification, the Ichneumonid in question being *Anomalon cerinops*, Grav.

Šulc (K.). **Die tschechoslowakischen *Lecanium*-Arten.** [Czechoslovakian Species of the Genus *Lecanium*. (*In Czech.*)]—*Práce Moravské přírodověd. Společn.* (*Acta Soc. sci. nat. morav.*), vii, fasc. 5, 134 pp., 64 figs., 28 refs. Brünn, 1932. (With a Summary in German.)

During the last few years, frequent and severe outbreaks of Coccids of the genus *Lecanium* have occurred on plums, ash and acacia

[*Robinia*], and in some districts on oaks, in Czechoslovakia. As lack of literature on the morphology of the insects concerned has rendered their identification difficult, the author has compiled the present monograph on the species occurring in Czechoslovakia, based on personal studies of almost forty years.

A section giving a general account of the anatomy of all stages of both sexes with notes on biology is followed by keys to the central European subgenera and species of each sex. The species are then dealt with individually, all stages being described, with notes on bionomics and synonymy. Of the subgenera one, *Pterolecanium*, containing the single species *Lecanium pulchrum*, King, which is the one injurious to oak, is new. The author discusses the identity of *L. corni*, Bch., and considers it to be a composite species, the Coccid recorded under this name as a pest of plums, etc., in central Europe being *L. coryli*, L.

The species of *Lecanium* in the collection of Signoret in Vienna are revised, and the literature on the wax-producing glands of these Coccids is briefly reviewed. Instructions for the collection and preparation of specimens are given.

[Mozgovoĭ (Yu. G.).] **Мозговой (Ю. Г.). On the Characteristics of the Behaviour of *Anthonomus pomorum* L.** [*In Russian.*]—*Bull. Plant Prot.* (1 Ent.), no. 6, pp. 31–36, 1 diag. Leningrad, 1932. (With a Summary in English.)

In connection with studies on the economic importance of *Anthonomus pomorum*, L. [*cf. R.A.E.*, A, xx, 233, 342, etc.], observations on the selection by the females of sites for oviposition were carried out in the summer of 1928 in an orchard in the Leningrad Government. For this purpose three types of apple trees, 25–30 years old, were chosen: those bearing flower clusters in which the central and peripheral buds respectively were better developed, and a variety that produced both types of inflorescences. No preference was shown by the ovipositing females for the central buds; in all cases the peripheral ones were more infested, irrespective of the type of inflorescence, probably because they were more exposed to attack. Buds that develop quickly, irrespective of their situation, usually escape infestation.

[Chugunin (Ya. V.).] **Чугунин (Я. В.). On the Problem of the determinative Development of the Ovary of the Apple Tree and on the Selection of Flower Buds by the Female of *Anthonomus pomorum* during Oviposition.** [*In Russian.*]—*Bull. Plant Prot.* (1 Ent.), no. 6, pp. 37–44, 5 refs. Leningrad, 1932. (With a Summary in English.)

Observations in 1926 near Nizhniĭ-Novgorod on the relation between infestation by *Anthonomus pomorum*, L., and the development of ovaries in the flower clusters of 15-year-old apple trees showed that about 12 per cent. of the central buds, which did not comprise more than one-third of all the flower buds present on the tree, produced fruit, as compared with only 2·5 per cent. in the case of all the other buds. The removal of the central buds from the clusters had no effect on the normal yield of fruit, as under these conditions more

fruit than usual is produced by the peripheral buds. It is thought that infestation makes itself felt only when the weevil destroys 70–80 per cent. of the total number of buds, though the entire crop may be lost when the number of infested buds is over 90 per cent. Moreover, it has been found that the slowly developing buds, which are of less economic importance, are the ones that chiefly become infested [see preceding paper].

VOUKASSOVITCH (P.). **Sur l'importance des insectes parasites entomophages dans les biocénoses des insectes.**—*C. R. Soc. Biol.*, cx, no. 21, pp. 499–501. Paris, 17th June 1932.

The results of studies carried out in Belgrade since 1922 [*cf. R.A.E.*, A, xx, 259, etc.], with a view to determining the importance of native entomophagous parasites existing in a given environment and being in constant contact with their hosts, are briefly reviewed, although they are inadequate to justify definite conclusions. With the exception of one case in which 98 per cent. of the pupae of *Pieris brassicae*, L., were parasitised by *Pteromalus puparum*, L., and another in which *Sarcophaga affinis*, Fall. (*Agria mamillata*, Pand.) caused a mortality of about 62 per cent. among individuals of *Hyponomeuta malinellus*, Zell., parasitism was very slight in the numerous insects studied. In the cases examined, no relation could be discerned between the activity of the parasites and the numbers of their hosts, the multiplication and dispersion of which were determined by other factors. It may be concluded that native parasites are not a decisive factor in regulating the number of their hosts, their action being in general intermittent and insufficient. One of the chief reasons for the weakness of parasitic activity may be found in the action of hyperparasites, of which several examples are given. The percentage of hyperparasitism in the parasite seemed to be invariably much higher than that of parasitism in the host.

PETCH (T.). **Notes on Entomogenous Fungi.**—*Trans. Brit. Mycol. Soc.*, xvi, pt. 4, pp. 211–245, 8 figs. Cambridge, May 1932. **Some Philippine Entomogenous Fungi.**—*Ann. mycol.*, xxx, no. 1–2, pp. 118–121. *Gibellula.*—*T. c.*, no. 3–4, pp. 386–393, 1 fig. Berlin, 1932.

The species dealt with in the first of these papers include : *Empusa lecanii* on *Aphis sacchari*, Zehnt., in the Philippines ; *Cephalosporium lecanii* on Aleurodids, and *C. longisporum* on *Icerya purchasi*, Mask., in Ceylon ; *C. indicum*, sp. n., on larvae of *Eublemma amabilis*, Moore, in Bengal ; *Spicaria gracilis* on *Saissetia coffeae*, Wlk. (*Lecanium hemisphaericum*, Targ.) and *Rhinotrichum parvisporum*, sp. n., on *Aspidiotus* and *Lecanium*, in Ceylon ; and *Aspergillus depauperatus*, sp. n., on *Lepidosaphes ulmi*, L., in England.

Verticillium heterocladum as described from Italy [*cf. R.A.E.*, A, xv, 622] is referred to the genus *Cladobotryum*, and another species, *C. ovalisporum*, sp. n., is described from a froghopper in Ceylon. The Florida species assigned to *V. heterocladum* [*loc. cit.*] is named *V. cinnamomeum*, nom. nov. It is parasitic on *Dialeurodes* (*Aleurodes*) *citri*, R. & H., and other insects.

SPEYER (E. R.). **Entomological Investigations.**—*17th Ann Rep. Exptl. Res. Sta. Nursery Mkt. Gdn. Ind. Devpmt. Soc. 1931*, pp. 49–55. Cheshunt, Herts, 1932.

Most of the thrips occurring in Britain in greenhouses in which tropical plants are grown are themselves of tropical or sub-tropical origin, and control measures having once been carried out there is little danger of reinfestation. Where commercial crops are grown, however, *Thrips tabaci*, Lind. (onion thrips) and *T. fuscipennis*, Hal. (rose thrips) are of common occurrence; both breed on plants in the vicinity of the greenhouses, in which they may become serious pests [*cf. R.A.E.*, A, xix, 639]. Brief notes are given on the bionomics of the former on cucumber, tomato and various hothouse flowers. A spray of 1 pint paraffin emulsion, 10 gals. water and 2 fl. oz. nicotine is an effective means of controlling it when exposed on the foliage of cucumber, but when it is in the flowers of cyclamen, arum or carnation, naphthalene (grade 16) broadcast over the plants at the rate of 10 oz. to 1,000 cu. ft. space is recommended. One application has caused almost complete mortality in severe infestations, and no injury to the flowers has been recorded. Owing to the probability of pupae occurring in the soil, in addition to any control measure, the soil round the plants should be watered liberally to hinder the emergence of adults and to cause the rapid decay of any straw on the borders of the beds in which pupae may be situated. Infestations on carnation are difficult to eradicate, and opening flowers showing discolouration of the petals should be removed and destroyed. As many as 30 larvae and adults of *T. tabaci* have been collected from one blossom.

T. fuscipennis causes severe injury to the flowers of certain varieties of rose grown under glass, and during the summer of 1931 was reported on cucumber from two widely separated localities for the first time. On cucumber the eggs were laid within the tissues of the opening flower, and the larvae migrated to the leaves where they fed with great numbers of adults, almost all of which were females. Pupation took place chiefly in the hollow ends of the stalks left from the cutting of the fruit or in crevices in the stem of the plant. The fertilised females leave their hibernating quarters (probably crevices in the structure of the greenhouse) in February, and both sexes of the first generation emerge towards the end of March.

Critical examination of many specimens collected from various plants growing under glass and in the open during the summer of 1931 indicated that the male of the typical form of *T. fuscipennis* is that described by Priesner as the male of *T. tabaci*. Male specimens of the latter have been received from Scotland and do not agree with any male described by Priesner. Under glass in England, however, it always breeds parthenogenetically [*loc. cit.*]. No constant structural characters were found distinguishing the females of *T. fuscipennis* var. *major*, Uzel, and *T. fuscipennis* var. *banatica*, Knechtel, from each other or from the typical form. These varieties occur in flowers grown out-of-doors in company with *T. fuscipennis*, but in smaller numbers. They have not been taken under glass. The male of *T. fuscipennis* var. *banatica* is that described by Priesner as typical *T. fuscipennis*. It is generally found only with the above varieties and is constantly different in characteristic structures from the typical male. It is concluded, therefore, that the rose thrips is a variable species in the flowers of plants grown in the open in the female sex

and that the male is definitely dimorphic. An increase in the numbers of *T. fuscipennis* appears to coincide with a decrease in the numbers of *T. tabaci* and *vice versa*. The small proportion of females of *T. fuscipennis* occurring in flowers infested with *T. tabaci* is another indication that there is some antipathy between the two species, though males of the former associate freely with females of the latter.

Infestation of roses might probably be controlled by a spray of 2 lb. potash soft soap, 10 gals. soft water and 2 fl. oz. nicotine. On cucumbers the paraffin and nicotine spray could be used, though two successive fumigations with naphthalene (grade 16) broadcast on the borders at the rate of 5 oz. to 1,000 cu. ft. gave good results in cucumber nurseries where a large area was treated by this method.

According to W. H. Read, it has been established that sulphonated oil [*R.A.E.*, A, xix, 639] at a concentration of 1 : 240 gives a complete mortality of the red spider mite [*Tetranychus telarius*, L.] and with careful application an almost complete mortality at 1 : 300. The higher concentration, unlike the more usual emulsified petroleum oil sprays, has a decided wetting effect, which is less pronounced on further dilution. No damage was caused to recently potted plants of tomato or cucumber by repeated applications at 1 : 240. The approximate cost of this spray at 1 : 240 is half that of petroleum oil emulsions, and its spreading action renders it more effective. A mixture of 6 oz. nicotine to 1 gal. sulphonated oil proved very effective in controlling Aphids when used at a dilution of 1 : 300.

The use of glue solutions for the control of *T. telarius* caused the development of fungi on the plants, the leaves of which adhered together. Spraying with 2 oz. glue to 1 gal. water killed a large number of the active mites, but failed to control the eggs and resting stages.

Barnes (H. F.). **Studies of Fluctuations in Insect Populations. I. The Infestation of Broadbalk Wheat by the Wheat Blossom Midges (Cecidomyidae).**—*J. Anim. Ecology*, i, no. 1, pp. 12–31, 6 figs., 8 refs. Cambridge, May 1932.

A project is explained in which the fluctuations of insect populations in the field are to be studied on a quantitative basis, using Cecidomyiids for the purpose. Three avenues of approach are used, *viz.*, the degree of infestation by the larvae, the degree of parasitism, and the dates of emergence (and number of broods). In this first contribution the wheat blossom midges, *Contarinia tritici*, Kby., and *Sitodiplosis mosellana*, Géh., have received attention, but a full discussion of the results obtained is being held over until the whole project, entailing similar studies on four other gall-midges, has been completed.

Fully fed larvae of *C. tritici* and *S. mosellana* have been taken in the field and reared to the adult stage in an outdoor insectary. Both these species have only one generation a year, though there may be a partial second in the case of *Contarinia*. The morphological and colour differences between the two species are discussed [*R.A.E.*, A, xvi, 229]. *C. tritici* is on the wing from the time that the wheat flowers break their sheaths until about 5 weeks later, that is, from early June to early July. The adults emerge in the evening from pupae in the soil, and mating and oviposition occur almost immediately. The females apparently live only a few hours, though sometimes as long as 2 or 3 days if no males are available. The eggs are deposited on

the inner surfaces of the glumes, and the larvae hatch in 8 days or less and feed on the sap that would form the kernel, thus preventing the formation of any corn. In about 4 weeks they are mature and jump to the ground, where they remain in the top 3 ins. in a semi-quiescent state until the following spring. They then become more active and pupate about 8 days before the ears of wheat break their sheaths. Occasionally about 10 per cent. emerge in August and September of the year in which the eggs are deposited; whether these can produce offspring on wild grasses is not known. Arthropods found attacking the adults of *C. tritici* included the Empid, *Tachydromia pallidiventris*, Mg., and adults of a mite, *Trombidium* sp., and *Empis livida*, L., was recorded as doing so by Curtis (1860).

S. mosellana has a life-cycle very similar to the above, but differs in that the larvae feed on the surface of the kernel as it is being formed, but do not enter it and so cause shrunken corn; only one or two larvae are found on one kernel and no secondary partial emergence has been observed. It has been found to oviposit on foxtail grass (*Alopecurus myosuroides*) and also attacks rye, barley and oats. Adults of *Trombidium* have been observed attacking the ovipositing females. The distribution of both species in the British Isles is discussed. The crest of oviposition for *S. mosellana* is a week later than that of *C. tritici*.

The fluctuations in intensity of attack by these species over a period of 5 years have been recorded and are shown in a table. The degree of infestation was determined by gathering samples of wheat ears each year from ten different plots about 3 weeks after the crest of emergence of the adults, when the maximum number of larvae were present in the ears. Manurial treatment did not appreciably affect the intensity of attack. Hymenopterous parasites reared in 1929 from larvae of *C. tritici* were the Platygasterids, *Isostasius punctiger*, Nees, and *Synopeas* sp., possibly *S. sosis*, Wlk., and from *S. mosellana*, the Miscogasterid, *Macroglenes penetrans*, Kirby, a Platygasterid that may be *Brachinostemma* sp., though it does not correspond with any species as yet described in that genus, and two undetermined species of *Platygaster*. A graph shows the daily emergence of *C. tritici* and its parasites in 1930 in the insectary; the parasites seem to emerge normally slightly later than their host. The percentages of parasitism as ascertained by breeding in the insectary in 1929, 1930 and 1931 were 10, 27 and 53 in the case of *Contarinia* and 73, 43 and 85 in that of *Sitodiplosis*.

FISHER (R. C.). **Prevention and Control of Damage by Wood-boring Insects.**—*Forestry*, vi, no. 1, pp. 67–74, 19 refs. London, June 1932.

In England, damage by insects to structural and manufactured timber is caused chiefly by the larvae of certain beetles and is of three distinct types, that caused by beetles that attack the tree before it is felled or while it is lying on the ground; that caused to hardwoods by powder-post beetles (*Lyctus*), which infest partly and recently seasoned timbers; and that caused by *Xestobium rufovillosum*, DeG. (death-watch beetle) and furniture beetles such as *Anobium punctatum*, DeG., which attack long-matured and old timber. In this paper the author outlines, with references to the literature, the

existing methods of prevention and control of infestation by these pests, indicates the lines on which research is being developed, and points out that new methods must depend on an accurate knowledge of the biological and ecological factors of importance in the life of the insects.

Liebermann (A.). **Ein Versuch zur Bekämpfung des Getreide-laufkäfers (*Zabrus tenebrioides* Goetze).** [An Attempt to combat the Corn Ground Beetle (*Z. tenebrioides*).]—*Prakt. Bl. Pflanzenbau u. Pflanzenschutz*, x, no. 3–5, pp. 68–73. Freising, 1932.

Notes are given on the biology of the Carabid, *Zabrus tenebrioides*, Goetze, which is an important pest of cereals in eastern Germany and other parts of Europe. The adults and larvae are briefly described. Most of the beetles appear at the end of June ; during the day they shelter under stones or lumps of earth, becoming active at night when they climb the stems of wheat, rye or barley and feed on the semi-mature seeds in the ears. Oats are seldom attacked. The eggs are laid in clusters in the ground and the larvae make burrows 4–8 ins. deep with an entrance hole surrounded by a small ridge of loose soil. They leave these at night and feed by gnawing the leaves of cereals to obtain the sap. They do not cut the leaves off, but often drag the tips into their burrows. The damage caused in the autumn is usually insignificant, but severe injury is done in the spring, young plants being often killed.

In Bavaria this beetle is usually found in small numbers only, but a severe local outbreak of the larvae occurred in April 1929 on valuable varieties of wheat cultivated for seed. In experiments on control on 16th April, the measures tested on different plots were spraying with 2 per cent. barium chloride, or a mixture of 1 lb. Urania green, 5 lb. quick-lime and 50 gals. water, and applying quick-lime to the soil by strewing a layer 4 ins. deep, or watering with a 2 per cent. solution. The results, which were observed on 1st May, showed that all these treatments, except the spray of barium chloride, which was apparently washed off by rain, were successful, as no more plants were attacked and many of the injured ones recovered. The larvae were prevented from migrating to other beds by strewing a line of quick-lime, 12 ins. wide and about 1 in. deep, along the edges of the infested plots. Varieties of wheat with stiff, upright leaves were considerably less attacked.

Papers noticed by Title only.

Mellanby (K.). **The Influence of Atmospheric Humidity on the Thermal Death Point of a Number of Insects.**—*J. Exp. Biol.*, ix, no. 2, pp. 222–231, 5 figs., 11 refs. London, April 1932. [See *R.A.E.*, B, xx, 162.]

Seyrig (A.). **Les Ichneumonides de Madagascar. I. Ichneumonidae Pimplinae.**—*Mém. Acad. malgache*, fasc. xi, 183 pp., 16 pls., 1 diag., 1 map, 8 refs. Antananarivo, 1932.

Hill (G. F.). **Australian Termites (Isoptera). Biological Notes and Descriptions of new Species.**—*Proc. Roy. Soc. Vict.*, xliv, pt. 2, pp. 134–154, 16 figs., 7 refs. Melbourne, 20th April 1932.

Hill (G. F.). **Termites (White Ants) in South-eastern Australia. A simple Method of Identification and a Discussion of their Damage in Timber and Forest Trees.**—*Pamph. Counc. Sci. Ind. Res. Australia*, no. 25, 28 pp., 1 pl., 16 figs., 1 ref. Melbourne, 1932.

Reclaire (A.) & MacGillavry (D.). **Naamlijst der in Nederland en het omliggend gebied waargenomen wantsen (Hemiptera-Heteroptera) met aateekeningen omtrent de voedsel- of verblijfplant en de levenswijze.** [List of Heteroptera of Holland and adjacent Regions with the Plants on which they feed or occur and Biological Notes.]—*Tijdschr. Ent.*, lxxv, pp. 59–258, 9 pp. refs. Amsterdam, 15th June 1932.

Mahdihassan (S.). **The Third Stage Larva of the Female Lac Insect (Hem. Cocc.).**—*Eos*, viii, no. 1, pp. 11–28, 20 figs., 9 refs. Madrid, 30th April 1932.

Slifer (E. H.). **Insect Development. V. Qualitative Studies on the Fatty Acids from Grasshopper Eggs.**—*Physiol. Zool.*, v, no. 3, pp. 448–456, 6 refs. Chicago, Ill., July 1932.

Ludwig (D.). **The Effect of Temperature on the Growth Curves of the Japanese Beetle (*Popillia japonica* Newman).**—*Physiol. Zool.*, v, no. 3, pp. 431–447, 4 figs., 20 refs. Chicago, Ill., July 1932.

Michal (K.). **Die Beziehung der Populationsdichte zum Lebensoptimum und Einfluss des Lebensoptimums auf das Zahlenverhältnis der Geschlechter bei Mehlwurm und Stubenfliege.** [The Relation of Density of Population to the Optimum and Influence of the Optimum on the Sex Ratio in *Tenebrio molitor*, L., and *Musca domestica*, L.]—*Biol. Generalis*, vii, no. 3, pp. 631–646, 2 figs., 11 refs. Vienna, 1931.

Liu (G.). **Catalogue and generic Synopsis of the Elateridae of China.**—*Lingnan Sci. J.*, xi, no. 2, pp. 211–247, 1 fig. Canton, 15th May 1932.

[Semenov-Tyan-Shanskiĭ (A. P.) & Medvedev (S. I.).] **Семенов-Тян-Шанский (А. П.) и Медведев (С.И.). Species Generis *Oryctes* III. Faunae rossicae et mesasiaticae (Coleoptera, Scarabaeidae).** [*In Russian* with key to species *in Latin*.]—*Ann. Mus. zool. Acad. Sci. U.R.S.S.*, xxxii (1931), no. 4, pp. 481–502, 5 pls., 1 ref. Leningrad, March 1932.

[Stark (V. N.).] **Старк (В. Н.). Beiträge zur Kenntnis der Borkenkäfer (Ipidae Coleoptera) Jakutiens. Wissenschaftliche Ergebnisse der Expedition der Akademie der Wissenschaften der U.S.S.R. nach Jakutien in 1925 und 1926.** [Contribution to the Knowledge of Bark-beetles (Scolytidae Coleoptera) of the Yakutsk Region. Scientific Results of the Expedition of the Academy of Science of the U.S.S.R. to the Yakutsk Region in 1925 and 1926.] [*In Russian*.]—*Annu. Mus. zool. Acad. Sci. U.R.S.S.*, xxxii (1931), no 4, pp. 541–558. Leningrad, March 1932. (With a Summary in German.)

[Aristov (M. T.).] **Аристов (M. T.). On the Economic Importance of the Apple Blossom Weevil** [*Anthonomus pomorum*, L.]. [*In Russian.*]—*Bull. Plant Prot.* (1 Ent.), no. 6, pp. 6–30, 5 diag., 1 map, 1 pl., 23 refs. Leningrad, 1932. (With a Summary in English.) [*Cf. R.A.E.*, A, xx, 233.]

Fulton (B. B.). **The Control of the Apple Curculio** [*Tachypterellus quadrigibbus*, Say] **by Hogs.**—*Circ. Iowa Agric. Expt. Sta.*, no. 117, 4 pp., 2 figs. Ames, Iowa, September 1929. [Recd. June 1932.] [*Cf. R.A.E.*, A, xvi, 504.]

Korff (G.) & Flachs (K.). **Die Erdflöhe und ihre Bekämpfung.** [Flea-beetles and their Control (a review of literature).]—*Prakt. Bl. Pflanzenbau u. Pflanzenschutz*, x, no. 3–5, pp. 53–60, 12 figs. Freising, 1932.

Wallengren (H.). *Metarrhizium anisopliae* **såsom Medel i Kampen mot** *Pyrausta nubilalis*, **Hb.** [*M. anisopliae* as a Means of Control of *P. nubilalis*.]—*Acta Univ. lund.*, (N.S.) xxvii, no. 2, art. 12, 15 pp., 2 figs., 8 refs. Lund, 1931. (With a Summary in German.) [*Cf. R.A.E.*, A, xix, 148.]

Bovien (P.). **On a new Nematode,** *Scatonema wülkeri* **gen. et sp. n., parasitic in the Body-cavity of** *Scatopse fuscipes* **Meig.** (**Diptera Nematocera**) [in Denmark].—*Vidensk. Medd. dansk. naturh. Foren.*, xciv, pp. 13–32, 7 figs., 7 refs. Copenhagen, 1932.

Sharga (U. S.). **A new Nematode,** *Tylenchus aptini* **n. sp., Parasite of Thysanoptera** (**Insecta:** *Aptinothrips rufus* **Gmelin**) [in Britain]. —*Parasitology*, xxiv, no. 2, pp. 268–279, 26 figs., 21 refs. Cambridge, June 1932.

Smith (C. R.). **Identity of Neonicotine and the Alkaloid Anabasine.**—*J. Amer. Chem. Soc.*, liv, pp. 397–399, 2 refs. Easton, Pa., January 1932

LaForge (F. B.) & Haller (H. L.). **Rotenone. XIX. The Nature of the Alkali Soluble Hydrogenation Products of Rotenone and its Derivatives and their Bearing on the Structure of Rotenone.**—*J. Amer. Chem. Soc.*, liv, pp. 810–818, 8 refs. Easton, Pa., February 1932.

Haller (H. L.) & LaForge (F. B.). **Rotenone. XX. The Structure of Tubaic Acid.**—*J. Amer. Chem. Soc.*, liv, pp. 1988–1994, 12 refs. Easton, Pa., May 1932.

Haller (H. L.). **Rotenone. XXI. The Structure of Isorotenone, Beta-Dihydrorotenone and Dehydrorotenol.**—*J. Amer. Chem. Soc.*, liv, pp. 2126–2128. Easton, Pa., May 1932.

Clark (E. P.). **Toxicarol. III. A Relation between Toxicarol and the Rotenone Group of Fish Poisons.**—*J. Amer. Chem. Soc.*, liv, pp. 1600–1602, 5 refs. Easton, Pa., April 1932.

Nelson (O. A.). **An Apparatus for measuring partial Vapor Pressures of Binary Liquid Systems.**—*J. Amer. Chem. Soc.*, liv, pp. 1390–1393, 1 fig., 5 refs. Easton, Pa., April 1932.

Young (H. D.) & Nelson (O. A.). **Binary System Carbon Tetrachloride-Ethylene Dichloride. Their Boiling Points and Specific Gravities as Aids in Analysis.**—*Ind. Engng. Chem.*, Anal. Edn., iv, p. 67 (reprint 5 pp.), 2 figs., 4 refs. Easton, Pa., 15th January 1932.

Zwölfer (W.). **Beiträge zur Kenntnis der Schädlingsfauna Kleinasiens II. Ueber die Beziehungen der Getreidewanze** *Eurygaster integriceps* **Put. zu biotischen Umweltfaktoren. (Nebst Bemerkungen über deren praktische Verwertbarkeit.)** [Contributions to a Knowledge of the Pests of Asia Minor, II. On the Relations of the Cereal Bug, *E. integriceps*, to Biotic Environmental Factors. With Notes on their practical Utilisation.]—*Z. angew. Ent.*, xix, no. 2, pp. 161–187, 8 figs., 15 refs. Berlin, June 1932.

This is a further account of observations on *Eurygaster integriceps*, Put., in Cilicia [*cf. R.A.E.*, A, xix, 300]. Wheat is the chief food-plant of this bug, its occurrence on oats, rye and *Sorghum* being occasional. It was not found on maize, but was sometimes observed feeding on grasses and even cucurbits and other plants. The injury to cereals is due in part to early spring feeding on the young plants, especially the stem and subsequently the ear, and in part to later feeding on the milky grains. Early spring feeding did not occur during a recent outbreak in Cilicia, but feeding on the grains resulted in some localities in losses of 80–90 per cent. Neither the larva nor the adult attacks mature, healthy grains, and it was found that the immunity of barley and certain varieties of wheat depends on the fact that they ripen early. Uniform cultivation of early maturing cereals would cause a decrease in the number of eggs laid, as the adults require maturation feeding, and direct destruction of the larvae by starvation.

The Scelionid egg-parasite, *Telenomus semistriatus*, Nees, various observations on which are recorded, is the only one of the natural enemies [*loc. cit.*] meriting consideration, but in the conditions obtaining in Cilicia it would be necessary to breed it on a large scale and maintain it through the summer and winter for distribution in the spring, and the outlay involved would not be justified, as outbreaks of the bug only occur at intervals.

Eliescu (G.). **Beiträge zur Kenntnis der Morphologie, Anatomie und Biologie von** *Lophyrus pini* **L. II. Teil.** [Contributions to the Knowledge of the Morphology, Anatomy and Biology of *Diprion pini*. Part II.]—*Z. angew. Ent.*, xix, no. 2, pp. 188–206, 15 figs., 41 refs. Berlin, June 1932.

This second part of a paper on *Diprion* (*Lophyrus*) *pini*, L. [*R.A.E.*, A, xx, 313] describes the process of spinning the cocoon, the two forms of the prepupal stage (eonymph and pronymph), the male and female pupae, and the emergence and internal anatomy of the adult, with notes on its habits. The larva begins to spin its cocoon 1–2 days after the last moult. The eonymph stage normally occupies 1–2 days for the first generation and 8–9 months for the second; in some cases, however, it may last for several years. The pronymph stage is always short (3–4 days). At 10°C. [50°F.] the pupal stage occupied 20 days, and at room temperature 10 days, whereas pupae that had been stored in an ice-chest for 2½ months completed development in 4 days at room temperature. The adult remains in the cocoon for 1–7 days before emerging. As a rule the female lives 6–10 days, and the male 9–10. No feeding occurs in the adult stage.

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GEIGER (R.). **Meteorologische Beobachtungen bei der mittelfränkischen Kieferneulenbekämpfung mit Flugzeug und Motor im Frühjahr 1931.** [Meteorological Observations in the Course of Work with Aeroplanes and Power Dusters against the Pine Moth in Central Franconia in the Spring of 1931.]—*Z. angew. Ent.*, xix, no. 2, pp. 207–222, 8 figs. Berlin, June 1932.

These data on the effect of meteorological factors on the application of dusts to forest trees were obtained in the spring of 1931 in pine stands in Bavaria during work against the pine Noctuid [*Panolis flammea*, Schiff.]. Air moisture facilitates the adherence of a fine dust insecticide, and rain has no effect except that of knocking the dust off the needles, so that a rapidly acting contact poison would be almost independent of rain if applied at the correct moment [*cf. R.A.E.*, A, xx, 314]. Movement of the air is thus the only important meteorological factor affecting the application of dusts. Dust applied from an aeroplane is drawn down by gravity and by an electrical force that is not fully understood. Dusting flights are permissible when the wind velocity at the height of the trees does not much exceed 2 miles an hour, or rather less if the wind is gusty; even with a slightly gusty wind of 2·2 miles an hour the dusting of the tree crowns was very thorough, especially with several applications during one flight. The microclimate of the stands and terrain have an influence on air currents. For instance, a thick canopy of tree crowns not only prevents the dust from falling mechanically, but also indirectly through maintenance of a higher temperature inside the stand than outside it. In Bavaria, air movements rendered visible by smoke are being recorded by cinematograph, and this method should prove valuable for observing the behaviour of dust clouds.

For work in forests the power duster is inferior to the aeroplane, for full use is not made of the finest division of the dust by scattering, nor is it possible to place the dust cloud where desired in spite of being able to aim the nozzle of the blower. When the dust spreads beneath the tree crowns the operator thinks that the crowns are entirely enveloped, and when it passes above them he cannot see the main body of the cloud. The region of the tree crowns is a sharply defined meteorological dividing belt, very distinct in temperature and moisture, especially in the morning and evening, at which times dusting is usually carried out. Dust falling from an aeroplane is simply retarded by this belt, but dust rising from a power duster below it is prevented from pervading the crown space. If there is an excess of power, the dust is driven through and above the belt, and it often happens that part of the dust spreads beneath the crowns and part shoots into the air above them, while the crowns themselves retain little. Dust driven into the upper air reaches a greater height than when it is distributed by an aeroplane and it cannot settle, owing to the constant blast from the duster below, so that contrary to the accepted view, power dusting requires calmer weather than aeroplane dusting. This is perhaps the reason why pine needles are less thickly covered when a power duster is employed. Moreover, even slight winds cause currents in the zone beneath the tree crowns through which the dust has to pass. Irregular application by a power duster is also due to the fact that various causes prevent it from travelling at a uniform pace.

Beling (I.). **Zur Biologie von** *Nemeritis canescens* **Grav. (Hymen. Ophion). I. Züchtungserfahrungen und ökologische Beobachtungen.** [On the Biology of *N. canescens*. I. Breeding Experiences and Ecological Observations.]—*Z. angew. Ent.*, xix, no. 2, pp. 223–249, 5 figs., 22 refs. Berlin, June 1932.

The Ichneumonid, *Nemeritis canescens*, Grav., is constantly found in flour-mills in Germany, where it parasitises the larvae of *Ephestia kühniella*, Zell. An account is given of observations made in the course of breeding it in the laboratory for a period of two years. Reproduction was exclusively parthenogenetic in observed cases, but some males occurred. The following is taken mainly from the author's summary: *N. canescens* has about 10–12 generations a year, and each female lays 15–20 eggs. Differences in colour and size occur in females of the same origin. They oviposit in full-grown larvae, preferably such as have spun their cocoons. As a rule only one egg is deposited in each puncture, but up to three may be laid simultaneously. Superparasitism occurs, as many as 29 parasites having been found in a single host larva, but only one develops, the others dying in the early stages. Total development requires 4–6 weeks at room temperature. The parasitised host very often lives until it has pupated. Occasionally a parasite leaves the host cocoon in the course of development; in such cases it almost always dies. The females can oviposit shortly after emergence and do so throughout their lives. They lived for 66 days when fed on honey and deprived of opportunities for ovipositing. When allowed to oviposit, they lived for not more than 7 days when fed, and 4 days when starved or supplied with water only. It is possible that the females obtain food from flowers in the open. They are to be found on the windows in mills, and at twilight they try to re-enter the mills in order to oviposit. They can survive temperatures of about 4°C. [39·2°F.] for 8–10 days, but at 0°C. [32°F.] all die in 7 days.

Fischer (K. R.). **Beiträge zur Ernährungsbiologie von** *Hylobius abietis* **L., und Untersuchungen über die Oekologie und Klimatologie seines Nahrungsraumes.** [Contributions to the Biology of Nutrition in *H. abietis* and Investigations on the Ecology and Climatology of its Feeding Space.]—*Z. angew. Ent.*, xix, no. 2, pp. 250–277, 2 figs., 23 refs. Berlin, June 1932.

These investigations on *Hylobius abietis*, L., were made in Hessen in 1930 to obtain basic data for control by studying the feeding and behaviour of the adult weevils and the effect of environment on them. According to the literature they prefer pines that have been planted out to those that have been sown, but in the author's experiments sown plants were attacked almost exclusively. In nature the green spring shoots of trees 5–6 ft. high are attacked, but possibly only owing to thirst, for such shoots were reluctantly accepted in the laboratory. In cambium feeding, old pines were preferred, and then, in order of preference, those 3, 15 and 5 years old. In a large-scale experiment with 3-year-old pines, some planted out in 1930 and some in the previous year, the weevils preferred the latter plants, which had become well established in the ground. In hot weather they seek shady places overgrown with weeds, and surfaces shielded by moss against dryness. The autumn feeding of the adults in August

and September is generally less intense than the spring feeding, which occurs chiefly in May and June.

The second part of the paper deals with the dependence on climatic influences of the initial spring population and daily activity of the adults, and on the dependence of injury on ecological factors. A certain amount of " preparatory warmth," acting for a time on the adult in its winter quarters in the ground, is required to render it ready to emerge. When it is thus ready, the immediate stimulus of a suitable temperature causes it to appear, thus giving rise to the daily accessions to the weevil population. In average day temperatures, the minimum preparatory warmth was found to be 11°C. [51·8°F.], and the minimum immediate stimulus 9–10°C. [48·2–50°F.], with an optimum of 13–14°C. [55·4–57·2°F.]. The daily increase in numbers of weevils is, however, not only affected by warmth, but also by atmospheric humidity, which retards emergence if very high or low. Temperature influences the daily activity of the adults, which remain hidden between noon and 2 p.m., and only begin to feed and mate after 5 p.m., becoming most active in the evening. They also feed just before sunrise. Activity is also influenced by the character of the immediate environment, so that zones of injury occur.

LANGENBUCH (R.). **Beiträge zur Kenntnis der Biologie von** *Agriotes lineatus* **L. und** *Agriotes obscurus* **L.** [Contributions to the Knowledge of the Biology of *A. lineatus* and *A. obscurus*.]—*Z. angew. Ent.*, xix, no. 2, pp. 278–300, 12 figs., 12 refs. Berlin, June 1932.

This is a report of some field and laboratory investigations in Schleswig-Holstein on obscure points in the biology of *Agriotes obscurus*, L., and *A. lineatus*, L., which are the chief Elaterid pests of cereals in Germany, the former being the more injurious. The technique employed is described. Data on the food of the adults are reviewed from the literature. The author never found adults of *A. obscurus* except on the ground, where they shelter under stones, etc. They were first seen early in May, mating occurred in June, and the first eggs were observed towards the end of the month. If the ground was dry at the surface they were laid at a depth where the moisture was suitable for their development. The longest incubation period observed was 26 days. Feeding, especially by the older larvae, was less intense in winter, from December to February, but if sufficient moisture was present the older larvae of both species could resist a temperature of −14°C. [6·8°F.] for several hours, and frost for several weeks. No preference was shown for a given cereal or for cereals over potato. It was found that the larvae of both species assemble where the soil has an acid reaction [*cf. R.A.E.*, A, xiv, 313].

The fact that wireworms sometimes disappear after a severe attack is due chiefly to vertical migration in the soil, a point of importance as regards control. Experiments, described in detail, were made to determine the conditions of soil-moisture most favourable for the larvae, and the optimum for both species appeared to lie between 60 and 90 per cent. of saturation. In tests with *A. obscurus* (the only species available at the time) sufficiently moist soil rich in humus proved more attractive than slices of potato, which are known to be highly effective baits. Plants are not attacked in the presence of sufficient moisture in the soil.

Friederichs (H. F.). **Zur Biologie von** *Ptinus tectus* **Boield.** [On the Biology of *P. tectus*.]—*Z. angew. Ent.*, xix, no. 2, pp. 301–306, 2 figs., 10 refs. Berlin, June 1932.

Ptinus tectus, Boield., a native of Australia, was introduced in Europe about 30 years ago, and was recorded in Germany in 1916. Information in the literature on its biology in Germany is reviewed. The author has bred some generations from cocoons in fish-food (probably crushed crabs) purchased in the spring of 1927. On 12th April adults were observed, which all died by mid-September. The first larvae appeared early in August; they nearly always remained beneath the surface of the fish-food. They were in cocoons by mid-September, and young adults appeared in late October and November, but only lived for a few days. Young larvae occurred again from mid-November onwards, with cocoons in mid-December, but the larvae in them did not pupate until February 1928. The first young adults appeared in March and April, and young larvae were seen in July. The larva and cocoon are briefly described. The prepupal stage lasts 6–8 weeks.

Andersen (K. T.). **Kann sich** *Calandra granaria* **L. im Mehl fortpflanzen?** [Can *C. granaria* breed in Flour?]—*Z. angew. Ent.*, xix, no. 2, pp. 307–311, 1 fig., 3 refs. Berlin, June 1932.

In existing literature it is stated that *Calandra granaria*, L., cannot breed in flour. In experiments made by the author, wheat flour was loosely poured into one glass jar, and pressed down, layer by layer, into another, and 50 adults of *C. granaria* capable of oviposition were placed in each on 16th November 1931. The jars were kept at 26°C. [78·8°F.], but in mid-January the temperature rose temporarily to 30°C. [86°F.] or perhaps even higher. On 29th January 1932 the 50 adults were found dead in the jar containing loose flour, all but two being on the surface of the flour. In the jar with tightly packed flour the upper half contained 61 adults and the lower 27 adults, 5 pupae and 3 larvae; most of the adults were dead. The pupae were in cases made of flour particles firmly cemented together. The author concludes from this and other tests that the fact that young larvae of *C. granaria* usually die in flour is not due to lack of albumen in the flour as has been supposed, but because the particles are too loose to give them support for their bodies and mouth-parts. Looseness of the flour is also the reason why eggs are not usually laid in it, as it is probable that the female only oviposits when able to bore with its proboscis a hole for the egg.

Gleisberg (W.) & Mentzel (F.). **Raupenleim-Laboratoriums-Prüfung 1931.** [Laboratory Tests of Banding Adhesives.]—*Anz. Schädlingsk.*, viii, no. 6, pp. 61–66, 4 diag., 3 figs., 4 refs. Berlin, 15th June 1932.

In continuation of experiments already noticed [*R.A.E.*, A, xx, 9, 184, 309], further laboratory and field tests were carried out in 1931–32 with a number of proprietary adhesives for banding, to determine their viscosity, resistance to heat and rain, etc. The results are tabulated. Their reactions to different factors artificially produced in

the laboratory were very similar to those in the case of corresponding natural factors. The qualities necessary in a good adhesive are outlined.

Beling (I.). **Schädlingsbekämpfung im 18. Jahrhundert.** [Control of Pests in the 18th Century.]—*Anz. Schädlingsk.*, viii, no. 6, pp. 66–69. Berlin, 15th June 1932.

This is a brief historical review of remedial measures advocated in the German and Austrian entomological literature of the second half of the eighteenth century against a number of insect pests. They included the placing of the predatory Carabid, *Calosoma sycophanta*, L., on fruit trees infested with caterpillars, the application of adhesives to the trunks and spraying the trees by means of a fire-hose ; the examination of trees for the presence of the nests of *Malacosoma neustria*, L., *Vanessa polychloros*, L., and *Aporia crataegi*, L., with subsequent removal and burning of such nests ; the scraping off of the eggs of *Porthetria* (*Lymantria*) *dispar*, L., from trees ; the cultivation of hemp round fields to safeguard the latter from the attacks of cabbage caterpillars ; and the use of cow manure in preference to horse manure, which seemed to offer favourable conditions for the breeding of *Euxoa* (*Agrotis*) *segetum*, Schiff. Instructions are quoted for the preparation of repellents for the treatment of seeds prior to sowing with a view to safeguarding them from the attacks of larvae in the soil.

Ulatowski (W.). **Die Bekämpfung des Maikäfers.** [The Control of Cockchafers.]—*Echa Leśne*, ix, no. 1, 1932. (Abstract in *Anz. Schädlingsk.*, viii, no. 6, p. 70. Berlin, 15th June 1932.)

In the Government of Kielce, Poland, the cultivation of buckwheat in recently felled areas in pine forests has given excellent control of Melolonthid larvae. Of young pines planted in the year following the sowing of buckwheat, only 5–6 per cent. were attacked, as compared with 60 per cent. in adjoining plots in which this crop had not been grown. The roots of buckwheat are evidently unsuitable as food for the larvae, which die of starvation, since other plants or grasses are usually unable to develop among it if it is densely sown.

Babel (A.). **Starkes Auftreten von** *Lyonetia clerkella*. [An Outbreak of *L. clerkella*.]—*Anz. Schädlingsk.*, viii, no. 6, pp. 70–71, 4 figs. Berlin, 15th June 1932.

In the autumn of 1931, a sudden and severe outbreak of *Lyonetia clerkella*, L., occurred on cherries near Cologne and Darmstadt, though it was practically absent from other stone fruit trees The larvae migrated to fresh leaves to pupate, 3–4 cocoons usually occurring on each. Numerous adults were present even after the first frosts.

Matsumura (S.). **Conspectus of Japanese Injurious Insects.** [*In Japanese.*]—971 pp., 116 pp., 51 pp., 70 pls. Tokyo, Meiji Publ. Co., April 1932. Price *Yen* 13.

Over 1,600 injurious insects occurring in Japan are described, and in some cases illustrated, and notes are given on their life-history and methods of controlling them.

Shimada (G.) **Experiments with Oil for controlling Leafhoppers in Rice-Fields and the Effect of the Water Temperature on the Diffusion of Oil.** [*In Japanese.*]—*J. Plant Prot.*, xix, no. 3, pp. 116–120, 195–200. Tokyo, February-March 1932.

Petroleum is commonly used for oiling the water in rice-fields for the control of Homoptera in Japan [*cf. R.A.E.*, A, xvii, 705]. It spreads best at a water temperature of 24–25°C. [75·2–77°F.], and only forms a comparatively poor film at 20°C. [68°F.].

Sawada (E.), Ikeda (N.) & Tanaka (K.). **Studies on *Prospaltella smithi* Silv., an Enemy of *Aleurocanthus spiniferus* Quaint. I.** [*In Japanese.*]—*Mater. Improv. Agric.*, no. 42, pp. 1–28, 2 pls. Tokyo, Govt. Japan, Min. Agric. For., Bur. Agric., March 1932.

Prospaltella smithi, Silv., the adult of which is described, was introduced in Kyushu from South China by Silvestri in 1925 to control *Aleurocanthus spiniferus*, Quaint., which is very injurious to *Citrus*. It has been established in the field and parasitises 43–75 per cent. of the Aleurodid, both insects having four generations a year in Kyushu. A single egg is laid in the first instar larva of the whitefly, which is killed in the pupal stage. The parasite larva hibernates in the second and third instar of the host, the adult emerging in March. Adults of the third and fourth generations live for about 15 and over 30 days respectively. The males far outnumber the females and pair several times a day.

Takagi (S.) & Ito (K.). **Studies on *Epilachna niponica* Lew.** [*In Japanese.*]—50 pp., 1 pl. Fukushima, Agric. Expt. Sta., Japan, March 1932.

Descriptions are given of all stages of *Epilachna niponica*, Lew., which is widely distributed throughout Japan, but is more common in the north. It attacks potato and other solanaceous plants, as well as cucumber, cherry, pumpkin, etc. There is one generation a year, the adults hibernating in sheltered places. In spring they become active when the temperature reaches 10°C. [50°F.] and begin to feed at 15°C. [59°F.]. Oviposition first occurs in mid-May and is at its height in June. The females oviposit for from 10 to 44 days, and lay 20–30 or more eggs a day or from 200 to 1,460 in all, usually on the lower surface of the leaves. The egg, larval and pupal stages last 5–7, 17–22 and 3–7 days ; the larvae remain dormant on the lower parts of the plants when it is hot and dry. The adults may live for more than a year, their abundance being influenced by the temperature when they emerge in May. Lead arsenate is considered the best insecticide for control, though derris, pyrethrum and nicotine sulphate are all very effective.

Imamura (S.). **Mermithidae parasitic in *Chilo simplex* and Leafhoppers. I.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 2, pp. 73–78, 7 figs. Tokyo, May 1932.

Amphimermis zuimushi, Kaburaki & Imamura, is parasitic in the larvae of the rice-borer, *Chilo simplex*, Butl., in Japan, sometimes attacking 76·22 per cent. of them.

Kobayashi (K.). **On the Life-history of** *Acanthocampa albofasciaria* **Leech.** [*In Japanese.*]—*Trans. Nat. Hist. Soc. Formosa,* xxii, no. 118–119, pp. 98–101, 3 figs. Taihoku, April 1932.

Observations in central Japan on the Geometrid, *Zamara excavata,* Dyar (*Acanthocampa albofasciaria,* auct.), which attacks mulberry, showed that there is one generation a year, the pupae hibernating in the soil, and the adults emerging in March. One egg-mass was found to contain nearly 800 eggs, and the larvae matured in 35 days.

Takahashi (R.). **Records and Descriptions of the Coccidae from Formosa. Part 2.**—*J. Soc. Trop. Agric.,* iv, no. 1, pp. 41–48, 3 figs. Taihoku, Formosa, March 1932.

Pseudococcus boninsis, Kuw., which has not previously been found in Formosa, is recorded from Taihoku on sugar-cane, and two new genera are described, as well as the following new species : *Trionymus taiwanus* on rice, *Phenacoccus asteri* on *Aster lauruleanus, Coccus takanoi* on sugar-cane, and *Lepidosaphes glaucae* on *Quercus glauca.*

Arakawa (H. Y.). **A new Cerambycid and Buprestid from S. Manchuria.** [*In Japanese.*]—*Kontyû,* vi, no. 1, pp. 15–19, 3 figs. Tokyo, April 1932.

The Cerambycid, *Purpuricenus pirus,* sp. n., and the Buprestid, *Chrysobothris manchurica,* sp. n., are recorded as boring in pear in southern Manchuria, the former killing trees 5 or 6 years old.

Hutson (J. C.). **Some Insect Pests of Tea in Ceylon. Nettle Grubs.**—*Trop. Agriculturist,* lxxviii, nos. 4–5, pp. 189–210, 255–286, 8 pls., 24 refs. Peradeniya, April–May 1932.

This paper includes all available data on the bionomics of the nettle grub (Limacodid) pests of tea in Ceylon, the information having been obtained from field observations covering many years and laboratory studies at Peradeniya. The species dealt with are *Natada nararia,* Moore, *Parasa lepida,* Cram., *Narosa conspersa,* Wlk., *Thosea cervina,* Moore, *T. recta,* Hmps., *T. cana,* Wlk., *Spatulifimbria* (*Spatulicraspeda*) *castaneiceps,* Hmps., *Scopelodes venosa,* Wlk., and *Belippa laleana,* Moore, the last two of which, although they have been recorded as feeding on tea, are at present regarded as negligible pests. Descriptions are given of all stages of these moths, except the eggs of the last two. Their life-histories and habits are very similar. The eggs are deposited on the older leaves, and the larvae eventually strip the bushes almost bare. The cocoons vary in size according to the species, but all are compact, oval or almost spherical, and composed of a cement-like substance that quickly hardens. The cocoons are most generally found as follows : *Natada nararia* on the ground or among fallen leaves, occasionally on the bushes ; *P. lepida* in clusters on the larger branches or stems and covered with loose threads ; *Narosa conspersa* on the upper surface of older leaves ; *T. cervina* probably just under the surface of the soil ; *T. recta* in clusters among the angles of the twigs or leaf stalks ; *T. cana* probably attached to leaves, twigs or stems, singly or in clusters ; *Spatulifimbria castaneiceps* on the upper surface of leaves ; *Scopelodes venosa* probably on leaves and stems ; and *B.*

laleana probably between two leaves. The moths live for 1–2 weeks, during which time the females oviposit practically every night. In the insectary *Natada nararia* deposited over 400 eggs; *Narosa conspersa*, *S. castaneiceps* and *T. cana* over 200, and *P. lepida* over 500. The indications are that the smaller species, such as *Natada*, *Narosa* and *Spatulifimbria* have a short life-cycle, ranging under laboratory conditions from 7 to 11 weeks, while the larger species, such as *P. lepida* and possibly *T. cervina*, require from 14 to 20 weeks. The food-plants will probably be found to be numerous and varied.

Most of the species have a fairly wide distribution throughout many of the important tea-growing areas of Ceylon, ranging from almost sea level to an elevation of about 5,000 ft. In general, nettle grubs seem to be only a periodical pest in some districts while in others they are tending to become a constant trouble. The periodicity in certain districts is probably due to natural enemies, such as parasites and wilt disease, the latter being encouraged by damp weather and over-crowded conditions. In such districts, extensive outbreaks are apparently preceded by one or two earlier and smaller invasions, and watch should be kept for spotting or other injury to the leaves, which is generally the first sign of unusual numbers, and as soon as such injury is observed, men should be sent over the affected area to collect and destroy the larvae and cocoons. In areas where one or other of these nettle grubs tends to be a constant pest, and where the tendency is for attacks to occur chiefly on young tea or fields within the first year from pruning, collection of larvae and cocoons should be carried on regularly and systematically throughout the year, at least two or three times a week. There are generally brief intervals during the year when there is a lull in the intensity of attack, and during these periods collections should be made daily if possible. The cost of such collecting is discussed, and it is suggested that co-operation among adjoining estates in making it a routine measure would result in mutual benefit.

Austin (G. D.). **The "Nettle Grub" Pest of Tea in Ceylon.**—*Tea Quart., J. Tea Res. Inst., Ceylon*, iv, pt. 3–4, pp. 74–87; v, pts. 1–2, pp. 4–16, 47–53, 34 refs. St. Coombs, Talawakelle, November 1931, February and May 1932.

This is a record of data obtained since April 1931 concerning nettle grubs on tea in Ceylon [*cf.* preceding paper]. The history of these pests is traced since 1872, and their food-plants and local distribution are discussed. Although no migration of the larvae has been observed, it would seem that it periodically takes place at night, and the larvae have on one occasion been observed to be carried by wind. Reference is made to Hutson's observation that during periods of heavy rain the larvae leave the tea bushes and assemble in large numbers on the under side of interplanted dadap (*Erythrina lithosperma*) [*R.A.E.*, A, xviii, 156]. It is suggested that it would be easier to lop dadap bearing the larvae than to prune infested tea. Pieces of hessian stretched beneath the dadap trees would prevent the larvae dropping on to the tea, or an adhesive could be applied round the trunks to prevent them crawling down and the foliage could then be sprayed with a contact insecticide.

Parasites bred from these Limacodids in Ceylon include, in addition to those recently noticed [*R.A.E.*, A, xix, 28, 573], *Apanteles parasae*, Roh., and *Eurytoma parasae*, Gah., from *Parasa lepida*, Cram.; the

Ichneumonids, *Goryphus variibalteatus*, Cam., and *Hemiteles* sp., and the Eulophids, *Euplectrus* sp. and *Tetrastichus* sp., all from *Natada nararia*, Moore; and the Tachinid, *Podomyia* (*Eurigaster*) *setosa*, Dol. from *Parasa lepida* and *Thosea cervina*, Moore.

During severe infestations, tea should be pruned if at the right stage; if the larvae are very young, the prunings might be buried, but if they are half-grown, the prunings should be immediately burnt. If pruning is impossible, a spray of 1 lb. laundry soap to 30–40 gals. water should be applied. On tea-seed bearers or young tea in clearings or nurseries, the spray should consist of 2 lb. lead arsenate or 1 lb. Paris green in 60 gals. water.

HUTSON (J. C.). **Some Insect Pests of Tea in Ceylon. The Lobster Caterpillar** (*Stauropus alternus* **Wlk.**).—*Trop. Agriculturist*, lxxviii, no. 6, pp. 327–336, 1 pl., 11 refs. Peradeniya, June 1932.

The Notodontid, *Stauropus alternus*, Wlk., all stages of which are described, has long been known as a minor pest of tea in Ceylon, but during the past 40 years only two important outbreaks have been recorded, in 1903 and 1928. The eggs are deposited singly along the edges of the leaves and hatch in about a week. The larvae prefer the older leaves for food and sometimes strip the bushes of all foliage. When mature they draw the edges of two or three adjacent leaves together and construct a cocoon within the shelter. In stripped or pruned areas the cocoons may be found on the stems and branches. The larval stage lasts 4–5 weeks and the pupal stage 1–3. A number of food-plants besides tea are attacked, including *Acacia*, *Albizzia*, *Cajanus indicus*, cotton, *Grevillea robusta*, mango and cacao.

The only parasite of this moth definitely recorded from Ceylon is the Tachinid, *Carcelia* (*Exorista*) *gnava*, Mg. [*R.A.E.*, A, xi, 19], which attacks the larvae. In 1903, crows were observed to destroy very large numbers of larvae and pupae. Collection of all stages of the moth wherever found is advocated as the best means of reducing its numbers. A spray of soap and water or other insecticide might be useful in checking small outbreaks under certain conditions. The adults can easily be destroyed during the daytime, when they rest on the stems of tea or of interplanted shade and green manure trees, or on rocks.

GONZALES (S. S.). **Further Studies of the Biology of the Migratory Locust** (*Pachytylus migratorioides* **Reiche and Fairm.**), **Locustidae Orthoptera.**—*Philipp. J. Agric.*, iii, no. 1, pp. 1–38, 7 pls., 28 refs. Manila, 1932.

In 1916 *Locusta* (*Pachytylus*) *migratoria migratorioides*, Rch. & Frm., appeared in 35 provinces of the Philippines, but in 1917 the Islands were declared free from this locust. From 1918 to 1922, however, the infestation increased annually. In the subsequent years it gradually declined, and in 1929 the last infested district was cleared. There still exists, however, a danger of the locusts breeding in the vast unexplored regions of the Archipelago. Observations on the bionomics of the locust were begun at the end of 1928, and numerous data were obtained, an account of which is given. A female was found to pair from 3 to 9 times during its life, and to lay up to five egg-pods, each containing from 12 to 32 eggs. Adults lived for from 16 to 95 days,

and the life-cycle from egg to egg lasted 95–115 days. Descriptions are given of the stages of the locust and of the male and female genitalia, and some observations on the phase transformation are quoted.

The usual control measures are discussed, and the necessity for closer co-operation in control work is emphasised.

Economic Advisory Council. **Committee on Locust Control. Fourth Report. Survey of Locust Investigations in 1931 and Programme of Work for 1932–33.**—Med. 8vo, 43 pp., 1 map. London, H.M.S.O., Cmd. 4124, 1932. Price 1*s.*

A review of the locust situation in Africa and western Asia during the period from May 1930 to January 1932 shows that *Schistocerca gregaria*, Forsk., continued to be active in almost all the countries previously affected. The invasion of *Locusta migratoria migratorioides*, Rch. & Frm., exhibited little signs of abatement in East Africa, where swarms penetrated as far to the south as Southern Rhodesia and even appeared in the north of the Union of South Africa. *Nomadacris septemfasciata*, Serv., swarms of which appeared in 1929 in Northern Rhodesia, spread over that country and into the Belgian Congo and even Angola ; an unconfirmed report was received of its appearance in South West Africa, and breeding on a small scale continued in the vicinity of Lake Chad. The further outlook with regard to the locust situation is, therefore, considered unsatisfactory, and the importance of discovering the original breeding areas is emphasised.

A report is presented of the locust investigations conducted by the Imperial Institute of Entomology, both in London where the information on locusts is collected and studied, and in the field, where preliminary ecological surveys of several areas in the Anglo-Egyptian Sudan, Kenya and Uganda are being carried out.

The programme of investigations during the period April 1932–March 1933 includes the extension of the work at the Institute and more detailed ecological studies in the field. A field laboratory is being established in the Sudan for studying the conditions of breeding of *Schistocerca* on the spot, and a similar laboratory is suggested in East Africa for investigating *Locusta*. The estimated cost of the investigations is £3,800.

An appendix contains an estimate of losses caused by locusts in different countries during 1927–31. The total expenditure on control measures during this period was not less than £1,000,000, while the total number of man-days occupied in controlling locusts is estimated at 28 million. The losses caused by locusts to crops are very imperfectly recorded, but known figures amount to about £6,000,000.

Munro (H. K.). **Notes on *Dacus ciliatus*, Lw., and certain related Species (Dipt. Trypetidae).**—*Stylops*, i, pt. 7, pp. 151–158, 1 fig. London, 15th July 1932.

The author discusses the synonymy of *Dacus ciliatus*, Lw., and the classification of the group of African Dacinae that are closely allied to it and may possibly represent a sub-genus. A key is given to the flies of this group. *D. brevistylus*, Bezzi, and *D. sigmoides*, Coq., are considered synonyms of *D. ciliatus*, which is widely distributed in Africa and attacks the fruits of various cucurbits, both wild and cultivated ; exceptional infestation of green beans and

tomatos has been recorded. In South Africa, about equal damage is done by it and by *D. vertebratus*, Bezzi. Parasites recorded from *D. ciliatus* are *Opius phaeostigma*, Wlksn., from the larvae in Natal, and *O. perproximus*, Silv., and *Biosteres caudatus*, Szép., from the pupae in West Africa [Dahomey]. *D. ciliatus* var. *duplex*, n., and two new species are described from South Africa; the latter attack milkweeds (Asclepiadaceae), and one of them, *D. mulgens*, has been recorded from *Asclepias fruticosa* as *D. brevistylus* [*R.A.E.*, A, xiii, 525].

Preparation and Application of Kerosene-pyrethrum Sprays against *Antestia* and *Lygus*.—*Ent. Leafl. Dept. Agric. Kenya*, no. 1, 2 pp. [Nairobi, 1932.]

Further details are given on the preparation and application of a kerosene-pyrethrum spray against *Antestia* and *Lygus* [*simonyi*, Reut.] on coffee in Kenya [*cf. R.A.E.*, A, xix, 645]. Holes are bored in the bottom of a galvanised iron drum, cotton wool is laid above these, and pyrethrum powder from locally grown plants is placed on the cotton wool. The requisite amount of kerosene (1 gal. to 1 lb. powder) is then allowed to pass slowly through the powder and filter thus made. By the use of a series of such filters, passing the kerosene through powder already used and finally through new powder, almost the total value of the powder may be extracted. In the case of commercial powders, 2–3 lb. to 1 gal. kerosene may have to be used, since they contain less insecticidal principle than the local ones. Prior to spraying, the trees should be covered with a sheet of unbleached calico (9 by 12 ft.) to retain the spray mist [*loc. cit.*], and the spray should be applied at the rate of 3 gals. per acre of 680 trees. Against *Lygus*, spraying should be done whenever the pest is present in numbers before a flowering. In the case of *Antestia*, the use of this spray is only justified if infestation is particularly severe and 2 or 3 applications of sodium arsenite bait spray [*cf.* xvii, 626] have failed to give satisfactory control, or in very rainy districts or during prolonged rainy periods.

Thor (S.). **Die erstbenannte *Tydeus*-Art, *T. croceus* (C. Linné) 1758, nach Dr. A. C. Oudemans' Identifizierung und Originalfiguren.** [The earliest-known species of *Tydeus*, *T. croceus*, according to Dr. A. C. Oudemans' Identification and Figures.]—*Zool. Anz.*, xcix, no. 3–4, pp. 58–63, 20 figs. Leipzig, 25th June 1932.

A description is given of the Eupodid, *Tydeus croceus*, L., found on willow in Sweden and Holland and on rye in Austria.

[Filip'ev (N. N.).] **Филипьев (Н. Н.) Lepidopterologische Notizen. xi. Einige Waldschädlinge aus der kaukasischen Schwarzmeer-litoralzone.** [Notes on Lepidoptera. xi. A few Forest Pests from the Caucasian Black Sea Littoral.]—*C. R. Acad. Sci. URSS*, A, 1931, no. 13, pp. 337–342, 5 figs., 10 refs. Leningrad, 1931. (With a Summary in Russian.) [Recd. July 1932.]

The five species of Lepidoptera dealt with, which are recorded for the first time from the Russian Union and were observed in the summer of 1930 in forests on the east coast of the Black Sea, include *Cydia* (*Laspeyresia*) *mariana*, Zerny, which had been recorded only from

Dalmatia, and the Tineid, *Brachyacma* (*Teleia*) *oxycedrella*, Mill., both bred from juniper berries in the northern Caucasus, and *Rhyacionia* (*Evetria*) *tessulatana*, Stgr., from cypress cones in Georgia. Descriptions are given of the male and female genitalia of *R. tessulatana* and of the male genitalia of *C. mariana*.

[Gusev (V. I.).] **Гусев (В. И.). Etude sur la biologie des deux espèces, Microlepidoptera** *Evetria tessulatana* **Stgr. et** *Laspeyresia mariana* **Zerny nouvelles pour la faune de l'URSS.** [*In Russian.*] —*C. R. Acad. Sci. URSS*, A, 1931, no. 13, pp. 343–349, 4 figs. Leningrad, 1931. (With a Summary in German.) [Recd. July 1932.]

In August 1930 serious local damage to the cones of cypress trees (*Cupressus*) was caused on the Black Sea coast of Georgia by *Rhyacionia* (*Evetria*) *tessulatana*, Stgr. [see preceding paper]. Brief descriptions of the adult, mature larva and pupa are given. The moths are on the wing from the second half of July to mid-August. The eggs, which are probably laid in the scales of the leaves of fruit-producing branches, hatch at the time of the formation of young cones in spring. The whole life of the larva is spent inside the cone, where it feeds on the central fibre and seeds. Pupation takes place in a white elongated cocoon in the tip of the cone. The infested cones do not develop and often drop to the ground. In one locality the cones also harboured larvae of *Cydia* (*Carpocapsa*) *splendana reaumurana*, Hein.

On the Black Sea coast of the northern Caucasus berries of *Juniperus* spp. were severely attacked by *Cydia* (*Laspeyresia*) *mariana*, Zerny, *J. excelsa* being preferred. The larva is briefly described, and the original description of the adult is quoted. There appear to be two generations a year, the adults being on the wing in the second half of June and first half of August. The larvae feed and pupate inside the juniper berries and also hibernate in them.

[Raevskiĭ (V.).] **Раевский (В.). On the Organisation of the Control of the Adult Moroccan Locust with poisoned Bran Mash.** [*In Russian.*]—*Bull. Plant Prot.* (I Ent.), no. 3, pp. 5–12. Leningrad, 1932.

Flying swarms of *Dociostaurus maroccanus*, Thnb., present a serious danger to crops, particularly cotton, in Central Asia. Observations on the behaviour of the swarms showed that the locusts feed before and during the oviposition period, and in field experiments they were readily killed by poison baits of the usual composition. The bait must be scattered very early in the morning, as the locusts are easily disturbed later on and even until late in the evening. Crops can be protected from swarms if the bait is scattered while they are settling. Some observations suggest that bait is taken by the adult locusts even if it is dry.

[Rubtzov (I. A.).] **Рубцов (И. А.). The Food-plants of Siberian Acrididae.** [*In Russian.*]—*Bull. Plant Prot.* (I Ent.), no. 3, pp. 13–31, 19 refs. Leningrad, 1932. (With a Summary in English.)

The food preferences of several of the more important Siberian grasshoppers were studied in the field by examining numerous sample

plots of natural vegetation populated mainly by individual species of grasshopper. The results showed clearly that grasshoppers are not omnivorous ; the number of plant species selected for feeding is very limited and does not exceed 6–10 per cent. of the total number present. Sometimes the selected plants constitute a very insignificant part of the natural vegetation, and even on overgrazed plots, where the vegetation is very poor so that the available food is restricted, the range of food-plants does not increase, although many other plants are nibbled and rejected. The range of food-plants generally extends with the development of the grasshopper larvae, though some plants are eaten by larvae and not by adults, which must be due to the hardening of the plant tissues with the advancing season.

In all the grasshopper species studied, the main food consists of Gramineae, but not all of them are eaten with equal readiness, *Hordeum* being generally preferred to all others, while *Setaria* and *Stipa* are avoided. Of the two most injurious species, *Gomphocerus sibiricus*, L., has a wider range of food-plants and is less strictly confined to grasses than *Chorthippus albomarginatus*, DeG. Amongst cultivated plants, barley and wheat are preferred ; rye and oats are also eaten, but millet, flax, potatoes, mustard and some other plants are scarcely injured.

[Rubtzov (I. A.).] **Рубцов (И. А.). The Habitats and Conditions of Grasshopper Outbreaks in East Siberia.** [*In Russian.*]—*Bull. Plant Prot.* (I Ent.), no. 3, pp. 33–130, 6 diag., 1 map, 81 refs. Leningrad, 1932. (With a Summary in English.)

Although the area subject to grasshopper outbreaks in Siberia occupies over 3,800 sq. miles, it represents only a narrow belt of the steppe country stretching from the Ural mountains to beyond Lake Baikal. Within this belt, the outbreaks are confined to agricultural districts, which suggests that they are connected with the disturbance of natural conditions by man. An extensive study of the ecological distribution of grasshoppers was made during three successive years. In each habitat, ten samples of the grasshopper population were taken by making ten "sweeps" with a net. The vegetation of the habitat was then analysed statistically, and the correlation between the frequency of a grasshopper species and the plant species was studied. The following general conclusions were reached :—

Every plant community has a characteristic grasshopper population, and for every grasshopper species there are plant species that serve as indicators of its presence in a habitat. This connection with plant indicators is often so close that even the relative abundance of a grasshopper is in direct proportion to the abundance of its indicator plant. Of the two most injurious species, *Gomphocerus sibiricus*, L., is closely connected with *Agropyrum cristatum*, occurring also in the neighbouring habitats characterised by *Echinospermum lappula*, *Cerastium arvense* and some other plants, and *Chorthippus albomarginatus*, DeG., occurs mainly in habitats with *Poa pratensis*. The indicator plants have no direct relation to the respective grasshoppers, but serve merely as an index to the microclimatic conditions most favourable to them.

The number of grasshopper species is largest in natural undisturbed habitats, such as open pine and birch woods, but the density of the grasshopper population in such habitats is usually low. On the other hand, poor, overgrazed pastures harbour only a few species, but the

actual number of grasshoppers is very great. This must be due to the instability of microclimatic conditions in the open habitats, which leads to outbreaks of the few species that are able to live under such conditions.

The most important factors determining the areas of distribution and of outbreaks of grasshoppers are temperature and humidity. The zone subject to outbreaks in Siberia has a mean temperature in the warm half of the year of 12–14°C. [53·6–57·2°F.]. The only parts of this temperature zone in which outbreaks occur, however, are those in which the spring rainfall is light (about 2–2·4 ins.), with 11·8 ins. total annual precipitation. Outbreaks coincide with dry years, and particularly with a dry spring. All other ecological conditions, such as the contour of the ground and vegetation are of importance in so far as they affect the microclimate of the habitat. Thus, southern slopes with an incline of 3–5° are very favourable to grasshoppers owing to effective drainage ; light soils are drier and warmer and so are more heavily infested ; and overgrazed pastures, which are also warm and dry owing to their sparse vegetative cover, represent one of the chief sources of outbreaks in Siberia.

Most grasshoppers change their habitats during their life-cycle, the adults living in one and migrating to another for oviposition. The difference in microclimate between the two habitats may be considerable, and the species with habitats in which this difference is greatest exhibit the greatest fluctuations in numbers, leading to outbreaks. Most of the species are little affected by parasites, but in the case of *Arcyptera microptera*, F. W., up to 40 per cent. of the egg-pods are sometimes infested by the larvae of *Mylabris quatuordecimpunctata*, Pall., which probably regulates the abundance of this grasshopper. The injury to crops does not depend solely on the abundance of grasshoppers, since most species are definitely restricted to undisturbed habitats and do not enter cultivated fields. Indeed, of 40 species common in the area, the only ones that can be considered as definitely injurious are *Gomphocerus sibiricus*, *Arcyptera microptera*, *Chorthippus* (*Stauroderus*) *scalaris*, F. W., *C. albomarginatus*, *C. apricarius*, L., and *C. biguttulus*, L.

The solution of the grasshopper problem in Siberia depends on the reorganisation of the present system of agriculture, the first step being to allow all overgrazed dry areas to regain their normal vegetative cover, by utilising for pasture more humid habitats unfavourable to grasshoppers. It might be possible to use the existing pastures for sowing certain grasses, such as *Agropyrum ramosum*, which grows in poor soils and forms a close turf avoided by grasshoppers. When practicable, as for example in river valleys, flooding would lead to changes in vegetation unfavourable to grasshoppers.

[Popova (A. A.).] **Попова (А. А.). On the Biology and Significance of the Red Spider** (*Eutrombidium debilipes* **Leonardi) as a Parasite of the Migratory Locust** (*Locusta migratoria* **L.).** [*In Russian.*]— *Bull. Plant Prot.* (I Ent.), no. 3, pp. 131–170, 2 pls., 3 figs., 2 graphs, 80 refs. Leningrad, 1932. (With a Summary in English.)

A detailed description is given of all stages of the red mite, *Eutrombidium debilipes*, Leon., a common parasite of various Acridids, particularly *Locusta migratoria*, L.

Observations in Daghestan showed that the adult mites hibernate in the soil and not in the egg-pods of locusts. In spring they search for locust eggs and suck them out, a male usually destroying two and a female three. Oviposition was observed from mid-April until mid-June. The eggs are deposited in the soil, at the depth of up to 4 ins., in clusters of 400–500. After 10–11 days a primary larva hatches and soon moults into an active larva, which, on finding a locust, becomes attached to it, usually on the intersegmental membrane, or on the wings in the case of adult locusts. The larva feeds on the locust for an average of about 30 days, but has practically no effect on it, except that heavily infested young hoppers are weaker and consume more food than normal ones. The mites pass on to the new integuments of the host when it moults and leave it only when they are ready to assume the resting stage, which lasts about 5 days. The nymphs then emerge and search for the locust eggs, which by that time are laid ; a nymph does not require the contents of more than one egg to complete its development. A second resting stage follows, and the adult mites emerge after 15–16 days ; they usually do not feed before hibernating in the soil.

The practical significance of the mites is very small, since they have no effect on the development or reproduction of the infested locusts. During migrations, they are carried by their hosts. As egg parasites they may occasionally be of importance, but cannot be considered a factor in regulating locust periodicity.

[Rohdendorf (B. B.).] **Роденорф (Б. Б.). Beiträge zur Kenntnis der zweiflügeligen Parasiten der Acrididen.** [Contribution to the Knowledge of Flies parasitic on Acridids. (*In Russian.*)]—*Bull. Plant Prot.* (I Ent.), no. 3, pp. 171–190, 10 figs. Leningrad, 1932. (With a Summary in German.)

Diptera observed parasitising *Schistocerca gregaria*, Forsk., in Russian Central Asia were *Stomatorrhina lunata*, F., and *Oophagomyia plotnikovi*, Rohd., found in the egg-pods, and *Blaesoxipha laticornis*, Mg. (*grylloctona*, Lw.), *B. filipjevi tertia*, Rohd., and *B. monticola*, Rohd., in the hoppers and adults. Four other species of flies bred from this locust were probably not parasites of living individuals as they are normally saprophagous. *Blaesoxipha rossica*, Villen., and *B. subamericana*, sp. n., were bred from *Gomphocerus sibiricus*, L. An illustrated key is given to the Palaearctic species of *Blaesoxipha* and *Locustaevora* parasitic in Acrididae.

Vayssière (P.). **Observations expérimentales sur le criquet pélerin (*Schistocerca gregaria* Forsk.).**—*C. R. Acad. Sci. Fr.*, cxcv, no. 2, pp. 94–96. Paris, 1932.

Sexually immature adults of *Schistocerca gregaria*, Forsk., taken from a swarm, remained immature and brownish in colour when kept in a cage at 18–20°C. [64·4–68°F.] in a dry atmosphere. When transferred to a temperature of 35–38°C. [95–99·4°F.] and an atmosphere of 50 per cent. relative humidity, they rapidly became yellow and in a few days began pairing and ovipositing. Adult locusts of the second generation did not mature if kept in ordinary room conditions, but some of them changed their colour to yellow after having been kept for 8 days at a temperature of 35–40°C. [95–104°F.], and a relative humidity ranging

from 60 to 100 per cent. ; they did not, however, pair till a month later. These experiments prove that sexual maturity can be attained without a migratory flight under the influence of high temperature and humidity. In experiments with hoppers hatched from eggs laid by typically gregarious locusts, those that were isolated suffered a high degree of mortality and developed less rapidly than those that were kept crowded. They rapidly changed their colour to yellowish-green and produced entirely green adults.

Bodenheimer (F. S.). **Oekologische Beobachtungen an** *Cimbex quadrimaculata* **(Hym. Tenthr.) in Palästina.** [Ecological Observations on *C. quadrimaculata* in Palestine.]—*Z. PflKrankh.*, xlii, no. 7–8, pp. 351–363, 5 figs., 5 refs. Stuttgart, 1932.

A detailed account is given of laboratory and field observations on *Cimbex quadrimaculata* var. *humeralis*, Geoffr., carried out during 1924–28 at Tel-Aviv, near Jaffa. In Palestine this sawfly occurs only in hilly areas and injures the foliage of almonds, apricots and peaches. The eggs, larvae and pupae are briefly described. There is only one generation a year, the summer, autumn and winter being spent in cocoons in cracks in the soil or under stones. The adults appear in the first half of March. Their activity depends on the temperature of the air, mass flight and oviposition occurring only in bright sunshine. In the laboratory, activity was greatest at 19–39·5°C. [66·2–103·1°F.], and death occurred in 30–60 minutes at –4·5°C. [23·9°F.] and immediately at 41·3°C. [106·34°F.]. The anatomy of the ovaries and process of oviposition are described. The eggs are laid singly in slits in the upper surface of the leaves, usually one to a leaf. On an average, a female lays about 80 eggs, which hatch in 10–15 days. The larvae feed on the leaves for about 25 days, and from mid-April to early May spin cocoons in which they pass the prepupal and pupal stages. In the laboratory, pupation took place in early February and the adults emerged about the end of the month.

About 5–15 per cent. of the larvae about to enter the cocoon stage were parasitised by the Ichneumonid, *Spilocryptus cimbicis*, Tschek, which emerges about the middle of April. No other natural enemies of the sawfly were observed. There is a high rate of mortality among the eggs (about 56 per cent. in the laboratory and 40 in the field) and immature larvae (80–90 per cent. in the case of the first instar and 85 per cent. in that of the second), owing to the dry, hot, desert winds, which frequently occur in April. The eggs are very susceptible to any deficiency in moisture, the optimum for them being 100 per cent. humidity.

The larvae of the second and third instars were successfully controlled by sprays of Urania green at concentrations of 0·2, 0·4 and 0·6 per cent. One of 0·8 per cent. was effective against fourth instar larvae, but caused slight scorching of the leaves.

Escherich (K.). **Ein neuer Fortschritt in der Forstschädlingsbekämpfung.** [A new Improvement in the Control of Forest Pests.]—*Forstl. Wschr. Silva*, 1931, p. 257, 1 fig. Tübingen, 1931. (Abstract in *Z. PflKrankh.*, xlii, no. 7–8, p. 408. Stuttgart, 1932.)

In view of the excellent results obtained in Bavaria in the summer of 1931 with a commercial contact dust insecticide against *Panolis*

flammea, Schiff., on pines [*R.A.E.*, A, xx, 314], the author strongly recommends its use against this Noctuid and the pine Geometrid [*Bupalus piniarius*, L.]. In the above trials no larvae of *P. flammea* were found on the trees four days after dusting, whereas before treatment they numbered 1,000–2,000 to a tree.

Werneck (H. L.). **Beiträge zur Einführung und Verbreitung der Blutlauszehrwespe in Oberösterreich.** [Notes on the Introduction and Distribution in Upper Austria of the Woolly Aphis Parasite.] —*Gartenbauwiss.*, v, p. 360. Berlin, 1931. (Abstract in *Z. PflKrankh.*, xlii, no. 7–8, p. 411. Stuttgart, 1932.)

Aphelinus mali, Hald., was introduced into Austria from France in 1926, and colonies were liberated at various points with a view to controlling the woolly apple aphis [*Eriosoma lanigerum*, Hausm.]. The parasite appears to be thoroughly established in Upper Austria, and near Linz successfully competes with the host in its rate of development.

Wahl (B.). **Einschleppung der San-José-Schildlaus in Mitteleuropa.** [The Introduction of the San José Scale into Central Europe.]—*Wien. landw. Ztg.*, lxxxii, no. 22, pp. 171–172. Vienna, 28th May 1932.

Aspidiotus perniciosus, Comst., was discovered on young pear trees in several nurseries near Vienna at the end of August 1931, and regulations were passed in accordance with which all the infested seedlings were destroyed, the nurseries put into quarantine, fallen leaves buried, fallen fruit burnt, and all the fruit trees and shrubs sprayed with carbolineum in autumn and lime-sulphur in spring before the buds appeared. Investigations showed that the scale was introduced on infested material from Hungary, where it has been present for about two years in nurseries near Szegedin. Since its discovery there, seedlings leaving the nursery are required to be fumigated for about one hour with hydrocyanic acid gas (Zyklon B, 0·2–0·5 volume per cent.) at a temperature of above 10°C. [50°F.], and the regulations for the inspection of export material have been made stricter. In Hungary a summer spray of nicotine proved more effective against it than carbolineum or lime-sulphur, which did not always give 100 per cent. mortality.

Schwartz (M.). **Auftreten der San José-Schildlaus in Ungarn und Oesterreich.** [The Occurrence of the San José Scale in Hungary and Austria.]—*NachrBl. deuts. PflSchutzdienst*, xii, no. 7, pp. 55–56. Berlin, July 1932.

Attention is drawn to the recent discovery of the San José scale [*Aspidiotus perniciosus*, Comst.] near Vienna [see preceding paper]. As a precaution against its introduction into Germany, a careful examination is recommended of all trees and shrubs that have been imported from Hungary or Austria during the last few years. Should its presence be discovered, close co-operation between the growers and official organisations for plant protection will be necessary in order that it may quickly be eradicated.

Hesse (E.). **Insektenfrass an** *Lilium martagon* **L.** [Insects feeding on *L. martagon*.]—*Z. wiss. InsektBiol.*, xxvii, no. 1–2, pp. 29–31, 3 refs. Berlin, 15th June 1932.

The chief pest of *Lilium martagon* in Brandenburg in 1931 [*cf. R.A.E.*, A, xix, 521, etc.] was found to be *Lioceris* (*Crioceris*) *lilii*, Scop., adults, eggs and larvae of which occurred in numbers on the plants from May to August, infestation being highest on stems that produced flowers. At the end of July the plants were completely defoliated and the beetles attacked the seed capsules. In the first half of August their numbers greatly decreased, single individuals occurring on *Convallaria* and *Polygonatum* only; the last adults were observed on 2nd September.

Plaas (G.). **Der Stachelbeerspanner** *Abraxas grossulariata* **L. in Schleswig-Holstein.** [The Gooseberry Geometrid in Schleswig-Holstein.]—*Z. wiss. InsektBiol.*, xxvi, no. 7–10, pp. 183–191; xxvii, no. 1–2, pp. 12–17, 2 figs., 46 refs. Berlin, 15th June 1932.

In 1928 *Abraxas grossulariata*, L., was unusually numerous near Kiel, and field and laboratory observations on the food preferences of the larvae were made from the autumn of that year until the spring of 1930. In the field, gooseberry and black and red currant were often defoliated, *Corylus avellana*, *Euonymus vulgaris* and *Prunus* being also attacked. In the laboratory, larvae taken in the field fed with varying degrees of readiness on 51 different plants. The fact that in Schleswig-Holstein the larvae are practically never recorded on gooseberry or currants is chiefly due to clean cultivation. In the autumn the young larvae do not feed much and are therefore not conspicuous. Subsequently, the fallen leaves, among which hibernation occurs, are removed and the soil turned over, most of the larvae being probably thus destroyed.

Only a few adults were present in 1929. This appears not to have been due to the effect of the severe winter, as in the laboratory larvae withstood very low temperatures. Of 197 larvae collected in the field in the spring of 1929, only 11 were parasitised, the parasites reared being two species of *Apanteles* and the Ichneumonids, *Anilastus inquinatus*, Holmgr., *Mesochorus vitticollis*, Holmgr., and *M. pectoralis*, Ratz. The author considers the last-named to be probably a hyperparasite.

Klein (H. Z.). **Studien zur Oekologie und Epidemiologie der Kohlweisslinge. II. Zur Bionomie von** *Pieris brassicae* **L. und deren Parasit** *Microgaster glomeratus* **L.** [Studies on the Ecology and Epidemiology of the Cabbage Butterflies. II. The Bionomics of *P. brassicae* and its Parasite, *Apanteles glomeratus*.]—*Z. wiss. InsektBiol.*, xxvi, no. 7–10, pp. 192–199, 7 refs. Berlin, 15th June 1932.

Details are given of weights and measurements of all stages of *Pieris brassicae*, L., laboratory and field observations on which were carried out in Palestine in 1926–31. It was found that small, light pupae and adults resulted from larvae that had developed under conditions of high temperature and low humidity, and consequently had passed through fewer instars than usual.

Observations on parasitism by the Braconid, *Apanteles* (*Microgaster*) *glomeratus*, L., confirmed statements in the literature that it only attacks the first instar larvae of *P. brassicae* [*R.A.E.*, A, ix, 38 ; xv, 554]. It did so, however, in spite of the fact that the larvae had already begun to feed on cabbage leaves [*cf.* ix, 110], which they did from the first day of their life, though they were not able to eject repellent fluid until after the first moult. At 12°C. [53·6°F.] and 86 per cent. humidity the pupal stage of the parasite lasted 24–25 days, as compared with 7–9 days at 19°C. [66·2°F.] and 73 per cent. humidity. In the laboratory, about 80 per cent. of the pupae gave rise to adults in the autumn and winter, the ratio of females to males being 5 : 2.

Reichert (A.). **Rosenschädlinge.** [Rose Pests.]—*Die kranke Pflanze*, ix, no. 2–3, pp. 20–24, 1 pl., 8 refs. Dresden, 1932.

This paper is one of a series [*cf. R.A.E.*, A, xviii, 504, 662 ; xix, 379, 641 ; xx, 189], and gives brief notes on the bionomics of the species of *Rhodites* occurring in Germany on wild and cultivated roses with descriptions of the galls produced by them.

André (M.). **Note sur un acarien** (*Penthaleus major* **Dugès) nuisible aux plantes potagères.**—*Bull. Mus. Hist. nat.*, (2) iv, no. 3, pp. 284–291, 8 figs., 20 refs. Paris, 1932.

Penthaleus major, Dug., was observed in numbers attacking vegetables, particularly lettuce, at Perpignan in February 1932. This mite has hitherto usually been found in damp places, among mosses or under stones, though a serious outbreak on peas was recorded near Hyères in January 1908. It feeds on the leaves of its food-plants, which become discoloured and dry up completely. All the individuals observed were females carrying 3–5 eggs, which are laid on the leaves. A detailed description is given of the adult female.

Zprava o škodlivých Činitelích kulturních Rostlin v Republice Československé v Roce 1930–1931. [Report on adverse Factors affecting cultivated Plants in the Republic of Czechoslovakia in the Year 1930–1931.]—*Ochr. Rost.*, xii, no. 1–2, pp. 1–63, 5 figs., 1 diag. Prague, 1932.

This survey of the diseases and pests of cultivated plants observed in various parts of Czechoslovakia in the year ending September 1931 includes reports by a number of authors on the damage caused by some 140 insects arranged under the crops attacked.

[Statelov (N.).] **Стателов (Н.). Ein pathogenischer Bazillus auf den Larven der** *Barbitistes amplipennis*. [A pathogenic Bacillus in the Larvae of *Isophya amplipennis*. (*In Bulgarian.*)] —*Mitt. bulg. ent. Ges.*, vii, pp. 56–61, 4 refs. Sofia, June 1932. (With a Summary in German.)

Bacillus barbitistes, sp. n., is described from the Tettigoniid, *Isophya* (*Barbitistes*) *amplipennis*, Brun., an outbreak of which occurred for the first time in Bulgaria in the spring of 1930. This bacillus brought the outbreak to an end in May, and in the following spring, in conjunction with the cold weather, kept the grasshopper in check. Its

cultural characteristics are discussed. When injected into the larvae it caused a mortality of 100 per cent., and 50–75 per cent. were killed when fed on leaves sprayed with a culture emulsion.

[Dryenski (P.).] **Дрѣнски (П.). Kleine entomologische Mitteilungen ii.** [Brief entomological Notes ii. (*In Bulgarian.*)]—*Mitt. bulg. ent. Ges.*, vii, pp. 62–77, 4 figs., 10 refs. Sofia, June 1932.

Curculio (*Balaninus*) *elephas*, Gyll., which is widely distributed in Bulgaria, is a serious pest of chestnuts near Petrich, sometimes damaging 70 per cent. of the crop. The adults emerge from the ground at the end of May, being most numerous in June and disappearing by July. They oviposit in the nuts through their spiny covering, one egg being laid in each. The larvae feed within the nuts and late in the autumn enter the ground for pupation. Since infested nuts cannot be distinguished from sound ones until they are abandoned by the full-grown larvae, all fallen nuts, as well as all those on the trees, should be collected at the time of harvest. Adults may be jarred from the trees on to sheets in May and June.

Ceuthorrhynchus sulcicollis, Payk., which has not previously been recorded as a pest of rape in Bulgaria, destroyed 50–70 per cent. of this crop in some localities in 1931. Eggs are laid in the autumn at the base of the stem, and the young larvae feed on the tissues at the root collar, causing galls, in which they hibernate. Each gall usually harbours 2–7 larvae. Infested plants turn yellow and do not develop. In spring the larvae resume feeding and enter the soil for pupation at the end of March or beginning of April, when the infested plants die.

The only practical measure consists in removing and burning the infested plants in March before the larvae have abandoned them. The field should then be ploughed.

Fisher (R. C.), Cann (F. R.) & Parkin (E. A.). **A Survey of the Damage caused by Insects to Hardwood Timbers in Great Britain.**—*Bull. Forest Prod. Res. Dept. Sci. Ind. Res.*, no. 16, 27 pp., 11 pls., 6 refs. London, H.M.S.O., 1932. Price 2*s.* 6*d.* net.

A preliminary account of part of this investigation, which has covered a period of 5 years, has previously been noticed [*R.A.E.*, A, xvii, 254]. The present report deals largely with the examination of timber in various states and conditions (during handling, storing, manufacture, in buildings, etc.) with regard to infestation by insects, particularly *Lyctus* spp. (powder post beetles). The kinds of timber attacked, the species of insects concerned, the losses caused by *Lyctus* and the methods of control practised in Britain are discussed. It was found that in warehouses conditions are in general very favourable for the development of *Lyctus*, the timber being kept in sheltered, dark, places and frequently left undisturbed for long periods. The beetles emerge in numbers on warm evenings and infestation is rapidly spread. The manufacturers of sports requisites are generally extremely careful in examining their goods, and any infested material is discarded and burnt. When using the sapwood of ash, they frequently subject the wood to steam-bending treatment; a temperature of 130°F. and a relative humidity of 100 per cent. maintained for 1½ to 2 hours will destroy the insect in timber one inch in thickness. After the bending treatment, however, the rough bends are often stored for some months,

and infestation may take place and render them useless for manufacture. *Lyctus* is often observed in the structural timbers of storage sheds and machine shops on the premises of manufacturers, where it subsequently attacks sound timber stored in them. Such infestations can be prevented if coniferous wood only is employed for these constructions, or if the sapwood is entirely eliminated from any hardwoods, Whatever the timber used, treatment with a coat of creosote is recommended. As a rule, importers, merchants and manufacturers fail to realise the seriousness of *Lyctus* infestation, largely because they confuse the damage with the less serious injury caused by pinhole borers, attacks by which cease during the process of seasoning. *Lyctus* is established in almost every timberyard and workshop where susceptible timbers, such as oak, ash, walnut and elm, are used, and both native and imported species of the genus are responsible for the spread of infestation. The American species, *L. cavicollis*, Lec., has recently been found in English ash. It is suggested that co-operation between importers at home and exporters abroad is essential in order to ensure protection to timber by kiln-sterilisation treatment, rigid systems of inspection, segregation of infested timber and the adoption of quarantine measures.

A number of Bostrychids also occur as wood-borers in tropical and sub-tropical regions and sometimes in temperate ones, attacking the sapwood of partly and recently seasoned wood, the injury being frequently attributed to *Lyctus*. The same methods of control are applicable. The following have been observed in Britain: *Bostrychus* (*Apate*) *capucinus*, L., from Austria, and *Schistoceros hamatus*, F., and *Prostephanus punctatus*, Say, from the United States, all in oak boards, the last-named being recorded for the first time in Britain; *Xylobiops basilare*, Say, in worked ash, hickory and persimmon from the United States; *Xylion adustus*, Fhr., and *Heterobostrychus brunneus*, Murray, together with *Lyctus*, in *Symphonia globulifera*, and *Xylopertha crinitarsis*, Imhoff, in African mahogany (*Khaya* sp.), from West Africa; and *Sinoxylon anale*, Lesne, in logs of *Ougeinia dalbergioides* from India.

Defects in timber caused by other wood-boring insects are also discussed. They include those that attack the trees or logs in the forest, such as pinhole borers (Scolytids and Platypids), longicorns, Lepidoptera, Lymexylonids and Brenthids; and Anobiids (furniture beetles), which only infest old and well seasoned timber.

Miles (H. W.). **The Control of Wireworms under Glass.**—*J. Minist. Agric.*, xxxix, no. 4, pp. 353–358, 2 refs. London, July 1932.

Owing to the recent developments in commercial horticulture in the British Isles, many new glasshouses have been erected on grass land or land recently broken up from grass or ley, and serious losses from wireworm attack have been recorded. In the open field the wireworm population is naturally reduced to negligible proportions in four or five years, as after the soil is broken up the adult beetles appear to migrate to adjoining undisturbed plots, where they oviposit. In glasshouses, however, they are unable to find their way out and are compelled to lay eggs in the soil of the houses, which tends to increase, or at least maintain, the infestation.

The method of using baits (particularly germinating wheat or oats) in conjunction with calcium cyanide [*R.A.E.*, A, xv, 63, 651] seems to afford a fairly effective means of control. If no hand drill is available, a spade may be used to cut a slit along the middle

of the bait row and worked backwards and forwards to widen it at the surface. The cyanide granules may then be poured in from a tin with a hole in the lid. When the application is completed, the ventilators should be shut and the house locked up for 24 hours as a precautionary measure. Since wireworm attack does not usually appear until after the first crop has been taken in the houses, it would seem advisable to experiment with some bait rows to discover if injury to the subsequent crop is probable.

MILES (H. W.). **The Control of Fruit Pests by Winter Spraying.**—*J. R. Lancs. Agric. Soc.*, 1932, reprint 16 pp., 3 figs., 3 refs. Preston, 1932.

An account is given of the results of experiments during recent years with a number of winter sprays against some of the more important pests of apple in various localities in Cheshire and Lancashire [*cf. R.A.E.*, A, xvii, 426]. Tar oil washes at 7–8 per cent. strength with scarcely an exception gave almost complete control of Aphids and *Psylla mali*, Schm. ; there was, however, some variation in their control of *Cheimatobia brumata*, L., Tortricids, etc. It was found that the efficiency of the spray may be affected from year to year by weather conditions during the time of application, and by seasonal variation in the incidence of the pests. The results against *Lygus pabulinus*, L., although somewhat inconclusive, indicate that tar distillate sprays may be of value in the control of this Capsid. Examination of the foliage of sprayed and unsprayed trees in 1930 showed that on 8th October the former carried over 60 per cent. of green foliage, and the latter only 30 per cent., and that the leaf fall of sprayed trees was correspondingly delayed. Moreover, in one instance, the yield of fruit on the untreated trees averaged 13 lb. per tree as against 71 lb. on the treated ones. In general a greater proportion of fruit on the sprayed trees was almost or entirely free from injury by insects.

Observations elsewhere have suggested that the use of tar distillates tends to increase infestation by *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.) [xvii, 501], but these investigations indicate that under some conditions certain tar oils may cause a reduction in its numbers, though they usually fail to do so. The degree of control of this mite obtained with three proprietary petroleum oil sprays varied from 65 to 92 per cent. and averaged 75 per cent. Since the latter sprays did not give effective control of such pests as Aphids and *Psylla mali*, tests were conducted with a combined spray of tar and petroleum oils, both being used at $7\frac{1}{2}$ per cent. strength, and good control of these pests and the mite was obtained.

General recommendations for winter spraying of fruit trees are given.

BONDAR (G.). **Notas biologicas sobre Bruchideos brasileiros do genero *Spermophagus*.** [Biological Notes on the Brazilian Bruchids of the Genus *Spermophagus*.]—*Correio agric.*, xi [*i.e.*, x], no. 4, pp. 55–59. Bahia, April 1932.

Spermophagus subfasciatus, Boh., is rarely found in the field, being a specific warehouse pest of various pulses. In Bahia, where it probably has 6–8 generations a year, it is particularly harmful to beans (*Phaseolus*) and cowpeas (*Vigna*). The female lives from 12 to 40 days, and at the optimum temperature of 28°C. [82·4°F.], the egg and

larval stages last 3–8 and 17 days respectively. At low winter temperatures the larval stage may be prolonged to 5 months. Up to 10 larvae have been found in one bean seed. Small quantities of beans may be fumigated with carbon bisulphide (3 oz. per 10 cu. ft.), but for large quantities, hydrocyanic acid gas is more economical.

Myers (J. G.). **Biological Observations on some Neotropical parasitic Hymenoptera.**—*Trans. Ent. Soc. London*, lxxx, pt. 1, pp. 121–136, 5 figs. London, 30th June 1932.

This paper includes biological notes on many of the parasitic Hymenoptera obtained by the author chiefly in British Guiana and the West Indies, which were recorded in a paper already noticed [*R.A.E.*, A, xix, 538].

Edwards (W. H.). **Control of Citrus Black Fly. The Introduction in Jamaica of a natural Enemy (*Eretmocerus serius*, Silv.) of the Citrus Black Fly (*Aleurocanthus woglumi*, Ash.).**—*J. Jamaica Agric Soc.*, xxxvi, no. 6, p. 280. Kingston, June 1932.

In April 1932 a consignment of the Eulophid, *Eretmocerus serius*, Silv., was sent by aeroplane from Cuba to Jamaica for the control of *Aleurocanthus woglumi*, Ashby, a serious pest of *Citrus* [*cf. R.A.E.*, A, xx, 428, etc.]. Attempts are being made to establish colonies of this parasite in three localities, and 250 individuals have been liberated.

Leonard (M. D.). **The Initiation of an Insect Pest Survey in Porto Rico.**—*J. Dept. Agric. Puerto Rico*, xvi, no. 1, pp. 59–64. Rio Piedras, P.R., 1932.

The organisation of an Insect Pest Survey in Porto Rico, in co-operation with the United States Bureau of Entomology, is briefly discussed. Its object is to obtain a detailed knowledge of the habits, seasonal and geographical distribution and relative abundance during different parts of the year of the species constituting the insect fauna in order that their economic importance may be determined. The benefits to be derived from such work, both local and international, are discussed, and reference is made to past and present faunal studies in the Island.

Wolcott (G. N.). **The Infestation of young Okra Pods by Pink Bollworm in Porto Rico.**—*J. Dept. Agric. Puerto Rico*, xv, no. 4, pp. 395–398, 2 refs. Rio Piedras, P. R., 1931. [Recd. July 1932.]

As it is hoped to increase the export from Porto Rico of pods of okra [*Hibiscus esculentus*] as vegetables and as the market requires that these should not be more than three inches long, it seemed possible that such young pods might escape infestation by *Platyedra* (*Pectinophora*) *gossypiella*, Saund. (pink bollworm). Investigation showed, however, that though under ordinary conditions infestation of okra pods does not occur, even the youngest pods may become infested when adjacent cotton is heavily attacked.

Felt (E. P.) & Rankin (W. H.). **Insects and Diseases of ornamental Trees and Shrubs.**—Demy 8vo, xix+507 pp., 243 figs. New York, The Macmillan Co., 1932. Price 25*s*.

This volume is a combination of the senior author's " Manual of Tree and Shrub Insects " [*R.A.E.*, A, xii, 485] and the junior author's

" Manual of Tree Diseases," entirely re-written and brought up to date. The first part includes a general account of the biology and depredations of insects attacking shade trees in North America and a chapter on insecticides and fungicides. The second and larger part consists of an alphabetical arrangement of the trees and shrubs, with accounts of the associated insects and fungi.

PUTMAN (W. L.). **Chrysopids as a Factor in the natural Control of the Oriental Fruit Moth.**—*Canad. Ent.*, lxiv, no. 6, pp. 121–126, 2 refs. Orillia, Ont., June 1932.

Investigations were undertaken in Ontario during the summers of 1930 and 1931 on Chrysopids, the larvae of which were found to destroy large numbers of the eggs of *Cydia* (*Laspeyresia*) *molesta*, Busck, by piercing the shell and sucking out the contents. Nine species and four varieties were taken in peach orchards, of which *Chrysopa rufilabris*, Burm., and *C. plorabunda*, Fitch, were much the most numerous.

The complete life-cycle of these two species averages about 31 days in the insectary, but it probably lasts longer in the field. In 1931 emergence began early in June, and as the larvae and adults were still active at the end of September it is concluded that there were at least two generations and probably three, with extensive overlapping. Considerable fluctuations were observed in the numbers present in the orchards. The greatest number of eggs of *C. rufilabris* were laid between 2nd and 16th July by the overwintering generation, the reason for the subsequent rapid reduction in abundance not being apparent. No individuals of the first generation of *C. plorabunda* were found in the orchards, and they must therefore have developed elsewhere or have been present in insignificant numbers.

Aphids were at first believed to be an important source of food for the Chrysopids, but it is doubtful if this is the case as the latter were very abundant in 1931, though Aphids had been scarce in 1930. In the insectary a higher percentage of larvae reached maturity when fed on the eggs of *Cydia molesta* than on any other food, the average number consumed by *Chrysopa rufilabris* being 535 and by *C. plorabunda* 511. Chrysopid larvae also undoubtedly attack the larvae of *C. molesta*, and they have been observed destroying those of the corn-borer [*Pyrausta nubilalis*, Hb.] in maize stalks.

Section of Plant Quarantine and Inspection.—*J. Econ. Ent.*, xxv, no. 3, pp. 427–476. Geneva, N.Y., June 1932.

This series of papers includes : Some regulatory Problems, by K. C. Sullivan (pp. 427–432) ; Plant Quarantine Service in Porto Rico, by R. Faxon and C. P. Trotter (pp. 435–447), which contains brief notes on the most important insect pests occurring on the Island ; Marketing California's early Potato Crop, an Example of Quarantine Entomology, by D. B. Mackie (pp. 457–461), which describes the fumigation of potatoes possibly infested with *Phthorimaea operculella*, Zell., with carbon bisulphide at the rate of 20 lb. to 100 cu. ft. of space, an exposure of 75 minutes killing all stages of the moth ; Sugarcane Insect Pests and Diseases with special Reference to United States Plant Quarantines, by T. E. Holloway and R. D. Rands (pp. 461–470), in which the insect pests of sugar-cane are briefly reviewed and an account is given of the measures adopted against their introduction into the United

States, great emphasis being laid upon the necessity for their strict enforcement ; and Fifty Years of Plant Quarantine Activity in California, by A. C. Fleury (pp. 470–476).

Camp (A. F.) & Wilmot (R. J.). **The Relation of Hydrocyanic Acid Gas Concentration to the Kill of various Stages of the Blackfly (*Aleurocanthus woglumi* Ashby).**—*J. Econ. Ent.*, xxv, no. 3, pp. 476–483, 1 fig., 2 refs. Geneva, N.Y., June 1932.

The Relation of Hydrocyanic Acid Gas Concentration to the Kill of various Stages of the Green Scale (*Coccus viridis*, Green).—*T. c.*, pp. 483–486, 3 refs.

In experiments carried out in Cuba in the spring of 1931, the larvae and pupae of *Aleurocanthus woglumi*, Ashby, on *Citrus* twigs or plants in pots were killed by an exposure of 30 minutes to a concentration of 0·2 per cent. of hydrocyanic acid gas at air temperatures of from 85° to 90°F., and adults were completely controlled by an exposure of 5 minutes or longer to a concentration of 0·03 per cent. In similar experiments with *Coccus viridis*, Green, concentrations as low as 0·08 per cent. resulted in 100 per cent. mortality after exposures as short as 30 minutes. Concentrations of 0·2 per cent. produced 100 per cent. mortality in 5 minutes. A fumigatorium referred to in a paper previously noticed [*R.A.E.*, A, xix, 315], equipped with thermostatically controlled heating coils and a fan to agitate the air, was used for the work.

Section of Apiculture.—*J. Econ. Ent.*, xxv, no. 3, pp. 495–530. Geneva, N.Y., June 1932.

This series of papers includes one entitled Resistance of Hybrid Honeybees to a Plant Poison in California, by G. H. Vansell and F. E. Todd (pp. 503–506), describing tests with various hybrid stocks of bees in regard to their resistance to poisoning by the Californian buckeye plant (*Aesculus californica*) which, when used as a source of nectar and pollen, seriously handicaps bee-keeping within its range.

Section of Extension.—*J. Econ. Ent.*, xxv, no. 3, pp. 530–544. Geneva, N.Y., June 1932.

Papers in this section include :—Orchard Spray Service, by M. P. Jones (pp. 537–539) ; The Spray Service in New York, by C. R. Crosby (pp. 539–542) ; and The Ohio Spray Service, by T. H. Parks (pp. 542–544).

Headlee (T. J.). **The Problem of Codling Moth Control.**—*J. Econ. Ent.*, xxv, no. 3, pp. 545–554, 1 graph. Geneva, N.Y., June 1932.

Recent progress in methods employed in controlling the codling moth [*Cydia pomonella*, L.] in the United States is outlined, the improvement being primarily in the use of stomach poisons and secondarily in that of tree scraping and lethal bands. Infestations, however, are still liable, under favourable weather conditions, to reach such dimensions in commercial orchards that growers are unable to obtain satisfactory control even by combining spraying and orchard sanitation. An attempt should therefore be made to discover a practical method whereby the moth population in an orchard, irrespective of its density,

can be so reduced within the limitations of a single season that excellent control may be secured at a practicable cost. As the factor of biological control seems to be unimportant and starvation control by killing all the bloom for one season, though effective, is not always practicable, it appears most feasible to attack *C. pomonella* in the overwintering larval stage when under conditions of clean cultivation the entire brood is present on the apple trees. Pine oils have proved very effective against this stage of the moth without apparent injury to the trees, and their possibilities for this purpose should be fully investigated.

MOORE (W.). **Comparisons between Nicotine Tannate and Arsenate of Lead as Codling Moth Poisons.**—*J. Econ. Ent.*, xxv, no. 3, pp. 554–559, 2 refs. Geneva, N.Y., June 1932.

Although chemical analyses of foliage treated with nicotine tannate have shown that, under New Jersey conditions, about 75 per cent. of the nicotine has usually disappeared at the end of 10 days [*R.A.E.*, A, xix, 358], a determinable amount always remains for 30 days or more. These small residues were at first considered negligible, but field experience has indicated that better control of *Cydia pomonella* L., is obtained with this material than with lead arsenate. Subsequent studies of the toxicity of nicotine tannate, details of which are given, have shown that it kills the more mature eggs and crawling larvae of *C. pomonella* as a contact poison and persists as a stomach poison on foliage in quantities toxic to the young larvae for at least 21 days. The cost of this material, which not only eliminates the problem of arsenical residues but appears to exceed lead arsenate in toxicity and effectiveness as a stomach poison, is not greater than that of the latter. In New Jersey, where tannic acid costs about 1*s.* 8*d.* a lb., one part of nicotine is used to 1,600 parts of water, and it is probable that considerable reductions both in cost and number of applications will shortly be made possible. Tannic acid is only satisfactory when made from Chinese galls [*Rhus semialata*], inferior tannins causing severe foliage injury. The tank should be filled two-thirds full of water, and after the agitator has been started, 2 lb. tannic acid should be added for each 100 U.S. gals. After this has dissolved, 1 U.S. pt. 50 per cent. free nicotine for each 3 lb. tannic acid should be added and the tank filled up before applying the spray. Nicotine tannate can be used with pure sulphur but cannot be mixed with soap, lime-sulphur, calcium caseinate or other alkaline or acid substances. Its compatibility with dried milk or other protein or organic base is open to question.

WORTHLEY (H. N.). **Studies of Codling Moth Flight.**—*J. Econ. Ent.*, xxv, no. 3, pp. 559–565, 1 fig. Geneva, N.Y., June 1932.

In order to obtain additional information as to the conditions governing the flight of *Cydia* (*Carpocapsa*) *pomonella*, L., with a view to developing the use of lights and baits as control measures, a study was made in Pennsylvania during the spring flight in 1931. Distance and direction of dispersal were studied through bait-pail catches of marked moths, and data relative to weather conditions affecting the beginning, peak and end of the daily flight period were gathered by hourly evening examinations of bait pails and weather instruments. The sexes appear to have similar flight habits, and the

moths tend to remain within 500 ft. of the point of emergence although they seek areas sheltered from the prevailing winds. Flight was found to begin before sunset, increase during the next hour and decrease with the approach of complete darkness. The flight period seemed to be prolonged by moonlight. Slight air currents did not inhibit flight, those from the south and west seeming more favourable than those from the north. Flight activity occurred below 60°F., increased with rising temperature and the attendant fall of humidity, and was greatest above 70°F. It appeared to be favoured by barometric pressure. Cloudy weather retarded moth activity, and light rainfall stopped it entirely.

Cory (E. N.) & Sanders (P. D.). **Tests against the overwintering Stage of the Codling Moth.**—*J. Econ. Ent.*, xxv, no. 3, pp. 566–569. Geneva, N.Y., June 1932.

Observations in Maryland have shown that infestation of *Cydia* (*Carpocapsa*) *pomonella*, L., is likely to be more severe in the neighbourhood of packing sheds than anywhere else in the orchard, owing to the greater protection afforded to the larvae hibernating within the sheds. In order to determine the effectiveness of various dormant sprays in killing larvae within hibernacula, 26 combinations were used upon larvae hibernating within 2-inch corrugated pasteboard bands. These bands were placed around heavily infested apple trees on 15th August and removed to outdoor screen cages on 23rd October. In the following spring they were dipped in the various solutions and replaced separately in the cages, the controls being treated with lime-sulphur or water. Finally, the daily emergence of moths and the number of dead larvae and pupae were recorded. Although this method does not give results representative of those that should be expected from orchard or packing house treatment, it seems well adapted to determine the materials that will penetrate the hibernaculum and serves to indicate those suitable for further test under field conditions. Satisfactory results were obtained with tar washes and pine oils at the higher concentrations, and their effectiveness was increased by the addition of para-dichlorobenzene. The latter, however, gave no significant increase in the less satisfactory mortality obtained with oil emulsions and soluble oils.

Mortality of 100 per cent. was obtained with bands treated with beta naphthol and beta naphthol with aluminium stearate, which were placed on the trees on 8th and 19th July. The bands were removed and placed in cages on 23rd October, and the dead larvae and pupae counted in the spring.

Hammer (O. H.). **Studies on Control of the Apple Curculio in the Champlain Valley.**—*J. Econ. Ent.*, xxv, no. 3, pp. 569–575, 1 pl., 5 refs. Geneva, N.Y., June 1932.

Injury by *Tachypterellus quadrigibbus*, Say, which was first observed in eastern New York in 1927, has recently assumed serious proportions there in a few apple orchards. Alternative food-plants include hawthorn and wild crab. Although serious injury may result from early spring feeding on pear, breeding does not occur on it to any extent, and no oviposition has been observed on cherry or plum. Whereas

no variety of apple seems to be free from attack, some appear to be more susceptible than others. The injury is caused by adult feeding and oviposition punctures, cavities being formed beneath the skin of the apple, which becomes misshapen. Losses are due to the feeding of both the overwintered adults, which in 1931 appeared during May, and of those of the new generation, which began to emerge during July. Oviposition began at the end of May, most of the eggs being deposited in the fruits while they were less than ½ inch in diameter. Except in rare cases, only one egg was deposited in a fruit. Oviposition extended over a period of 45 days. Although many of the new generation emerge from apples that drop during June, some issue from mummified fruit remaining on the trees or continue their development in growing fruits. All stages of the weevil were found alive in apples at picking time (4th–18th September). Hibernation studies indicate that the winter is passed in débris under trees that had been infested the previous summer.

Control measures recommended by various workers are briefly discussed. Tests carried out in 1931 indicate that arsenical sprays applied during the feeding and oviposition period in the spring give measurable control, although it is not clear whether the considerable decrease in injury is due to killing the beetles, repelling them or both. A spray consisting of 6 lb. lead arsenate, 2½ U.S. gals. lime-sulphur, 25 lb. hydrated lime, 1 U.S. qt. fish oil and water to make 100 U.S. gals. appeared to give the best control in 1931, the standard formula consisting of 3 lb. lead arsenate, 2½ U.S. gals. lime-sulphur and water to make 100 U.S. gals. apparently being ineffective. Some injury to the foliage resulted in most cases where fish-oil was used, accompanied by a reduction in the amount of fruit set. Cryolite and lead arsenate appeared to offer most promise in tests for the control of late summer feeding by the new generation.

Phipps (C. R.) & Dirks (C. O.). **Dispersal of the Apple Maggot.**—*J. Econ. Ent.*, xxv, no. 3, pp. 576–582, 1 pl., 1 fig., 6 refs. Geneva, N.Y., June 1932.

An account is given of the results obtained and the technique developed in a study of the dispersal of *Rhagoletis pomonella*, Walsh, which is now regarded as the most important pest of apple in Maine. Out of a total of 1,035 flies, some were etherised and others subjected to a temperature of 35°F. to facilitate marking them. Longevity tests showed the latter method to be preferable. The flies were released in 9 lots from the same point but under varying conditions. Neighbouring apple trees were searched at intervals during the course of the experiment which lasted from 8th July till 7th August, marked flies being recovered by means of shell vials. The flies lived for long periods after recapture when fed on slices of apple, a longevity of 7 weeks being recorded in the case of 4 individuals. A total of 123 flies, or 11·8 per cent. of the number released, were recovered between 17th July and 7th August. Of these, 26·8 per cent. were taken between 38 and 75 yards from the point of release, 56·9 per cent. between 75 and 96 yards and 16·3 per cent. between 96 and 156 yards.

Wind appears to be a stimulus causing the flies to spread in many directions, serving either as aiding their flight or conveying attractive odours. Rain always inhibits flight. Temperatures below 60 or above 90°F. tend to reduce it, but those between 75 and 85°F. encourage

dispersal. Feeding and reproduction are the most important factors governing dispersal, and natural barriers, such as buildings and hedges probably hinder it. It is often a gradual process, the flies migrating from tree to tree in accordance with seasonal change in varietal preference. *R. pomonella* will apparently readily travel 150 yds. in search of desirable fruit and would probably travel much greater distances under certain conditions.

CHAPMAN (P. J.), REED (T. W.) & FOX (R. H.). **Some Notes on the Control of the Apple Leafhopper** *Typhlocyba pomaria* **McAtee.**—*J. Econ. Ent.*, xxv, no. 3, pp. 582–586, 1 fig., 1 ref. Geneva, N.Y., June 1932.

Preliminary notes are given on the seasonal development of *Typhlocyba pomaria*, McAtee, in western New York and the Hudson valley, where the leaves of mature apple trees often become stippled and sickly as the result of feeding by these leafhoppers. In 1931 the first brood hatched in May and the second during the latter half of August. Overwintering eggs are laid during late September and in October in the bark of apple, generally in branches of about 1 inch in diameter and smaller. Attempts to destroy the eggs with oil sprays and tar washes applied to trees in a dormant or semi-dormant condition have been unsuccessful up to the present. Although the hatching periods in the two districts seem to have been fairly parallel in 1931, there was a considerable divergence in the times of appearance of the nymphs and bud development between the two areas. These differences may be due to variations in soil type, air, soil drainage and culture, as well as to regional differences in the hatching period. The nymphs are readily killed by nicotine sprays, and since the hatching period of both broods was found to be short in 1931, a single correctly timed treatment may effect a high percentage of kill of a brood. Observations indicated that 22nd–25th May was the period for using a contact insecticide against the first brood in 1931, and about 1st September (in the Hudson valley) against the second. Approximately 50 per cent. of the leaf hoppers had become adult by 15th September, and since adults and large nymphs cause most of the injury to leaves and fruit, treatments should be made as soon as possible after hatching is finished.

REED (T. W.). **Experiments on the Control of** *Empoasca fabae* **Harris on young Apple Trees.**—*J. Econ. Ent.*, xxv, no. 3, pp. 587–591, 2 refs. Geneva, N.Y., June 1932.

Empoasca fabae, Harr. (potato leafhopper) is a serious pest of apple nursery stock, and the damage it causes to the leaves results in stunting and malformation of the plants. For control it has been necessary to dip repeatedly the growing tips in a mixture of nicotine and soap at standard strengths, and in 1930 and 1931 spraying experiments with various contact insecticides and Bordeaux mixture were undertaken in New York in the second half of July to determine a more satisfactory measure. Nicotine sulphate with the addition of soap or dry-mix lime-sulphur proved effective against the nymphs though reinfestation in approximately similar numbers soon occurred in all the treated plots. Bordeaux mixture, when used at a concentration of 2–2–50 or stronger, resulted in a high degree of control, reinfestation during the remainder of the summer being very slight.

Bigger (J. H.). **An Addition to the List of Parasites of the Sunflower Weevil, *Desmoris fulvus* (Lec.).**—*J. Econ. Ent.*, xxv, no. 3, p. 591. Geneva, N.Y., June 1932.

Of eleven parasites of *Desmoris fulvus*, Lec., found during the examination of sunflower seeds in Illinois in November 1931, ten were *Microbracon mellitor*, Say, and one *Eupelmus cyaniceps* var. *amicus*, Gir., which has not previously been recorded from this weevil. *M. mellitor* has been found in all examinations of infested seeds and is likely to be an important aid in the control of *D. fulvus*.

Richardson (H. H.). **A preliminary Study of the insecticidal Efficiency of the Pyrethrins, Nicotine and Rotenone against the Greenhouse Red Spider Mite.**—*J. Econ. Ent.*, xxv, no. 3, pp. 592–599, 7 refs. Geneva, N.Y., June 1932.

Preliminary results of tests carried out to compare the insecticidal efficiency of nicotine, rotenone and the pyrethrins against *Tetranychus telarius*, L., have shown that these materials have little toxicity against this mite without the addition of some wetting agent, even when used at high concentrations [*cf. R.A.E.*, A, xix, 101].

The following is taken from the author's summary: With the addition of 0·25 per cent. potassium oleate soap, rotenone at 0·02 per cent. is slightly more toxic than the pyrethrins (0·02 per cent.); nicotine is much less toxic than either of these two, approximately 0·66 per cent. being necessary to produce a mortality equivalent to that produced by the above concentrations of the other two poisons. With sulphonated castor oil as the wetting agent, the pyrethrins and rotenone at 0·02 per cent. are about equivalent in toxicity; nicotine again is much less toxic, about 0·2 per cent. being necessary to equal the insecticidal efficiency of the other two at the concentrations given. Potassium oleate soap at 0·25 per cent. and 0·5 per cent. is approximately equivalent in toxicity to sulphonated castor oil at 0·5 per cent. and 1 per cent. respectively. Soap is more efficient than sulphonated castor oil as a wetting agent for rotenone and the pyrethrins. With nicotine, however, the reverse appears to be true. Nicotine (1–500) makes distinctly alkaline the almost neutral 0·5 per cent. sulphonated castor oil, but has a relatively slight effect on the already alkaline soap solution. Alcoholic extracts of the pyrethrins have an acidic effect when added to either sulphonated castor oil or soap solution. Acetone solutions of rotenone have very little effect on the pH of either of these wetting agents.

Ginsburg (J. M.). **Experiments with Waxes as possible Carriers of Insecticides.**—*J. Econ. Ent.*, xxv, no. 3, pp. 599–607, 8 refs. Geneva, N.Y., June 1932.

The following are the author's summary and conclusions: Greenhouse and orchard experiments with solid waxes of vegetable, animal and mineral origins were carried out with the purpose of studying their insecticidal properties as well as their efficiency as carriers of arsenical substitutes. The waxes were emulsified by the aid of triethanolamine oleate. Wax emulsions alone and impregnated with extracts of pyrethrum flowers and derris root were tested on *Aphis pomi*, DeG., *Anuraphis roseus*, Bak. (*Aphis sorbi*, auct.) and *Bombyx mori*, L.

Emulsions of the following waxes produced no injury to apple and peach foliage : spermaceti, candelilla and paraffin in concentrations of 4 per cent. or lower of actual wax content. Emulsions containing 1 per cent. wax possess appreciable toxicity as contact insecticides and practically no toxicity as internal insecticides. When impregnated with either pyrethrum or derris extracts, emulsions containing 1 per cent. wax possess high toxicity to both sucking and chewing insects.

HARTZELL (F. Z.), PARROTT (P. J.) & STREETER (L. R.). **Experiments with Tar Distillate Sprays.**—*J. Econ. Ent.*, xxv, no. 3, pp. 607–613, 1 ref. Geneva, N.Y., June 1932.

Investigations of tar distillate sprays, which have been in progress in New York for several years [*R.A.E.*, A, xix, 360], were continued on broader lines during 1931, when a number of brands of tar washes and a home-made emulsion of American creosote oil, which included all the fractions distilling between 200 and 360°C., were examined as regards their constitution, effects on insects and toxicity to trees. The trials were carried out on a number of commercial plantings of apples, together with some spraying of pears and peaches. The chemical constitution as regards distillation range, acid content and types of washes are briefly discussed.

The following is taken mainly from the authors' summary : At proper dilutions the emulsions seem to be effective against *Anuraphis roseus*, Bak., *Lepidosaphes ulmi*, L., *Aspidiotus perniciosus*, Comst., and *Psylla pyricola*, Först. They were also reasonably effective against *Eucosma* (*Spilonata*) *ocellana*, Schiff., but did not seem to given any control of *Conotrachelus nenuphar*, Hbst., *Syntomaspis druparum*, Boh., *Tortrix* (*Cacoecia*) *argyrospila*, Wlk., or *Typhlocyba pomaria*, McAtee, and had only a slight effect on *Heterocordylus malinus*, Reut., and *Lygidea mendax*, Reut. Whereas no permanent injury was observed on apple trees, mixtures containing more than 8 per cent. of tar oils were generally quite destructive to swelling buds even though they had not reached the silver tip stage. Mixtures containing less than 8 per cent. tar oils varied in destructiveness to buds according to dilution and variety of apple, but in no case was the damage severe as regards the set of fruit. A 4 per cent. mixture did not injure the swollen buds of peach or pear in limited tests. Mixtures of tar oils and lubricating oils proved very toxic to apple buds. The practicability of these for orchard use is discussed. It is pointed out that under New York conditions the apple frequently retains its foliage until severe weather arrives, thus precluding late autumn or early winter treatment. Continued cold weather also affords little opportunity for true winter applications, so that reliance is placed in late winter or early spring spraying.

HOUGH (W. S.). **The Efficiency of Tar Distillate Sprays in controlling San José and Scurfy Scales in 1931.**—*J. Econ. Ent.*, xxv, no. 3, pp. 613–617, 10 refs. Geneva, N.Y., June 1932.

The development of the use of tar distillate washes in the control of various types and stages of insects in Europe is briefly outlined, and an account is given of experiments to determine their value in controlling *Aspidiotus perniciosus*, Comst., and *Chionaspis furfura*, Fitch, on apple

in Virginia. A season's tests with 5 coal tar distillate sprays, 4 of which were of English origin, showed that only the higher concentrations (1–10 and possibly 1–15) are likely to give control of *A. perniciosus* somewhat comparable with that obtained with a standard petroleum oil emulsion of 3 per cent. oil. These concentrations also gave fairly promising results against *C. furfura*. Some of the tar distillates were more efficient than others having the same boiling range.

TURNER (N.). **The Mexican Bean Beetle in Connecticut.**—*J. Econ. Ent.*, xxv, no. 3, pp. 617–620. Geneva, N.Y., June 1932.

Since its discovery in Connecticut in 1929 [*R.A.E.*, A, xvii, 728], *Epilachna corrupta*, Muls. (Mexican bean beetle) has become well established throughout the State. Two rather sharply defined generations occurred in 1931, the first during June and July and the second during July and August. In laboratory investigations on food-plant selection, it was observed that the duration of the larval period on *Vigna sinensis* and *Dolichos lablab* was considerably longer than on other leguminous plants. A list is given of several leguminous food-plants (grown in test plots) in order of preference, *Vicia faba* being the only variety grown in Connecticut that is immune from attack.

The following applied four times during August to late string and lima beans gave successful control of *E. corrupta* without injuring the foliage: a spray of 2 lb. magnesium arsenate, 3 lb. casein lime and 100 U.S. gals. water; and dusts of magnesium arsenate and hydrated lime and barium fluosilicate and hydrated lime, both at the rate of 1:6. The spray gave a greater degree of protection than the dusts. The use of calcium arsenate (as a spray or dust) and proprietary dusts containing copper, lime and lead or calcium arsenate has given good results, but lead arsenate alone or with lime or Bordeaux mixture in most cases caused injury to the leaves.

HUCKETT (H. C.). **Tests with Arsenicals on Beans for the Control of the Mexican Bean Beetle.**—*J. Econ. Ent.*, xxv, no. 3, pp. 620–625. Geneva, N.Y., June 1932.

During 1931 field experiments were undertaken on Long Island to compare the amounts of injury caused to bean foliage by five arsenicals, the analyses of which are given, suitable for the control of *Epilachna corrupta*, Muls. (Mexican bean beetle). The sprays were applied at the rate of 200 U.S. gals. an acre and the dusts at 40 lb., and the results were estimated by the weight of pods to a row and the average weight per plant. Magnesium arsenate as a spray or a dust was the most satisfactory material [*R.A.E.*, A, xix, 353], though it is one of the most expensive. Of the sprays, basic lead arsenate was also consistently superior, but is expensive. Bordeaux mixture increased the value of all arsenicals, particularly calcium arsenate, rendering the results with the latter comparable with those from the more reliable though more costly materials. The average efficiency of dusts of zinc arsenite and basic lead arsenate was lowered by the addition of hydrated lime; the efficiency of all the arsenicals was considerably increased with the use of copper-lime mixture. In the case of the hydrated lime, relatively higher yields were obtained when the dust mixtures were applied to dry foliage than to foliage moistened with dew. Experiments were undertaken to determine the effect of the addition of various proportions

of hydrated lime (either alone or in Bordeaux mixture) to calcium arsenate in reducing the amount of foliage injury caused by the latter, which is the most generally used and cheapest arsenical for vegetable crops. The yield was found to rise with the increase of hydrated lime when added alone, but when the quantity of lime in the Bordeaux mixture was increased, the yield decreased. This decrease may have been due to the fact that more copper tends to remain on the plant when the proportion of hydrated lime is increased. The highest yields were obtained with the addition of Bordeaux mixture at the rate of 4 lb. copper sulphate, 6 lb. lime and 50 U.S. gals. water.

Langford (G. S.) & Cory (E. N.). **Observations on the Potato Tuber Moth.**—*J. Econ. Ent.*, xxv, no. 3, pp. 625-634, 3 refs. Geneva, N.Y., June 1932.

The following is largely taken from the authors' abstract: *Phthorimaea operculella*, Zell. (potato tuber moth) caused serious losses to the potato crop in Maryland in 1925 and 1930. Temperature is an important factor regulating the rate of growth in all stages of the insect. Outbreaks coincide to a remarkable extent with certain climatic factors, hot, dry years appearing to be most favourable for development. In each year of heavy infestation the temperatures during the growing season were far in excess of the normal, and the rainfall below the normal, particularly during April-July. Calculations based on the number of day degrees required for development indicate that years in which the moth occurred, there was a sufficient accumulation of day degrees to make possible an additional brood. The intensity of infestations in a given area appears to vary in proportion to the amount of rainfall.

Simpson (G. W.). **Spraying and Dusting Experiments for the Control of Potato Aphids.**—*J. Econ. Ent.*, xxv, no. 3, pp. 634–639. Geneva, N.Y., June 1932.

A series of experiments was conducted on Long Island during 1930–31 to determine the relative toxicities of various mixtures containing nicotine sulphate and the mechanical efficiency of spraying and dusting practices against Aphids on potatoes. In general it was found that dusting with a canvas trailer was more effective than spraying. Sprays containing potash fish oil soap were consistently more satisfactory than any others tested. Penetrol and nicotine together gave better results than when added to Bordeaux mixture. The materials were found to be more effective on plots sprayed throughout the season with Bordeaux mixture than on those treated with an 80–20 dust.

The efficiency of materials toxic to Aphids are influenced by mechanical factors to a relatively slight degree. Counts of the Aphid population on plants before and after the application of control measures showed that the greatest numbers were present on the lower portions of the plant and this clearly indicates the necessity of thorough application. A large proportion of the Aphids surviving treatment were *M. persicae*. The incidence of entomophagous fungi, which seem to keep the Aphids so well in check, appears to be influenced by spraying. Most of the infested Aphids were *Macrosiphum gei*, Koch (*solanifolii*, Ashm.), and *Myzus persicae*, Sulz., was only occasionally attacked.

Poos (F. W.). **Biology of the Potato Leafhopper, *Empoasca fabae* (Harris), and some closely related Species of *Empoasca*.**—*J. Econ. Ent.*, xxv, no. 3, pp. 639–646, 5 refs. Geneva, N.Y., June 1932.

A preliminary summary is given of observations carried out in Virginia from 1929 to 1931 on the biology of *Empoasca fabae*, Harr., and five closely allied species, information being given on the duration of the various stages and the food-plants on which the nymphs were reared. *E. fabae* is recorded, apparently for the first time, from California, where it causes yellowing and dwarfing in lucerne. Attempts to crossbreed some of the species were unsuccessful, except in the case of two out of eight attempts with the two strains of *E. fabae* from Virginia and California, but the resulting progeny were not numerous.

No overwintering individuals of *E. fabae* could be found, and hibernation could not be induced in cages. It first appeared in the field as a fertilised female on lucerne from 10th to 16th May each year, and it appears probable that this species migrates northward each spring.

Wolfenbarger (D. O.). **Muckland Potato Spraying Experiments.**—*J. Econ. Ent.*, xxv, no. 3, pp. 647–649. Geneva, N.Y., June 1932.

The results are given of experiments carried out in New York with Bordeaux mixture (5 lb. copper sulphate, 7 lb. lime and 50 U.S. gals. water) alone or combined with 2 lb. calcium or lead arsenate, with a view to finding a satisfactory spray programme for the protection of potatoes on muck land. This type of land is being increasingly used for the growing of this crop, and its high organic and moisture content, the resulting vigorous growth, large yields and environmental factors all tend to produce conditions peculiar to this industry. To eliminate differences in yields caused by the feeding of the Colorado potato beetle [*Leptinotarsa decemlineata*, Say], all the plants received one application of calcium arsenate prior to the experiments. *Epitrix cucumeris*, Harr., was the most numerous pest, though *Empoasca fabae*, Harr., was common from 15th July. All the treated plots showed a significant increase in yield over the untreated; lead arsenate and Bordeaux mixture gave the highest, and calcium arsenate and Bordeaux mixture the lowest, Bordeaux mixture used alone giving a slightly better yield than when added to calcium arsenate.

Rawlins (W. A.). **Studies of Potato Tuber Defects in Western New York.**—*J. Econ. Ent.*, xxv, no. 3, pp. 649–651. Geneva, N.Y., June 1932.

The types of injury caused to potato tubers in western New York by the feeding of various insects and other pests are discussed. A survey in eight counties shows Elaterids, millepedes, *Sciara* sp. and *Pnyxia scabiei*, Hopk., to be the most common causes of such injury.

Ditman (L. P.). **The Infestation of the Corn Ear by *Chloridea obsoleta* Fab. in regard to Time of Silking.**—*J. Econ. Ent.*, xxv, no. 3, pp. 652–655, 1 graph, 1 ref. Geneva, N.Y., June 1932.

It has been shown that most of the eggs of *Heliothis* (*Chloridea*) *obsoleta*, F., deposited on maize are laid on the silks [*cf. R.A.E.*, A, xix, 633], and it may be concluded therefore that these eggs are largely responsible for infestation of the ears. The timing of control measures,

however, should not be based on this assumption since oviposition continues from the time the plants are 1 ft. high until after the ears are fully formed, probably as long as the stalks remain green. Experiments in Maryland in 1929 showed that the average infestation in plots in which the silks had been cut off at the tips of the husks at intervals of 1–3 days was 69 per cent. of that in untreated plots. In investigations in 1931, little bud and tassel injury and practically no infestation of young ears were observed at the time the silks appeared, and the total infestation was found to increase most rapidly between the 2nd and 8th days after silking in each of three plots planted at different times during the summer.

MUNDINGER (F. G.) & CHAPMAN (P. J.). **Plant Bugs as Pests of Pear and Other Fruits in the Hudson Valley.**—*J. Econ. Ent.*, xxv, no. 3, pp. 655–658, 1 pl. Geneva, N.Y., June 1932.

Serious injury to pears was caused in New York in 1931 by the Pentatomids, *Euschistus euschistoides*, Voll., *E. variolarius*, P. de B., and *Nezara* (*Acrosternum*) *hilaris*, Say, particularly the last, *E. tristigmus*, Say, *Podisus maculiventris*, Say, and *Coenus delius*, Say, being also present in some orchards. *N. hilaris* occurred in numbers on maize in one locality and was also occasionally observed on apple, and *Euschistus* sp. was seen on peaches in several orchards. As a result of the feeding of the bugs, depressed areas appear on the fruit, and in one instance 95 per cent. of the pear crop had to be discarded.

BUTCHER (F. G.). **Studies of the Striped and Spotted Cucumber Beetles.**—*J. Econ. Ent.*, xxv, no. 3, pp. 658–662. Geneva, N.Y., June 1932.

A preliminary account is given of experiments on the control of the striped and spotted cucumber beetles [*Diabrotica melanocephala*, F. and *D. duodecimpunctata*, F.], which have recently caused serious losses to the cucumber crop in western New York, with Bordeaux mixture (3–4–50) and copper-lime dust (20 : 80), both with or without the addition of calcium arsenate. In general the dusted plants gave the greatest increase in yields, and the mixtures with calcium arsenate proved superior to those without.

Application by hand was more effective and more economical than by power dusters and sprayers.

MAUGHAN (F. B.). **Studies of the Onion Thrips.**—*J. Econ. Ent.*, xxv, no. 3, pp. 662–670. Geneva, N.Y., June 1932.

In tests with various materials against *Thrips tabaci*, Lind., which occasionally causes considerable losses to the onion crop in New York, nicotine sprays and dusts were in general most effective, and many materials of different character, such as kerosene, pyrethrum products, naphthalene and copper sprays or dusts gave high degrees of control, some of them probably acting as repellents.

HILL (L. L.). **Protection of Celery from Tarnished Plant Bug Injury.**—*J. Econ. Ent.*, xxv, no. 3, pp. 671–678. Geneva, N.Y., June 1932.

Lygus pratensis, L. (tarnished plant bug) is a serious pest of celery in New York. The feeding and oviposition punctures it makes in the

leaf stalk cause the latter to turn dark as if infested with bacterial rot. Cultures from badly infested stems have produced bacterial growth, but inoculation of these into healthy plants has failed to produce injury. In 1930, no noticeable injury was done until early September, after which damage by the adults increased rapidly until harvest, the increase being in proportion to the maturity of weeds growing in vicinity to the celery. Many more adults emerged from hibernation in 1931 than in the previous year. Eggs were deposited in weeds during May, and the first brood matured in June, large numbers migrating to celery, in which they oviposited. By the end of July, 5–30 nymphs were present on practically every plant. The injury was extremely heavy in early celery, and in a few fields the entire crop was unfit for market.

The most satisfactory of a large number of repellents tested on a small scale during 1930 were selected for more extensive experiments in 1931. Applications of finely ground sulphur as a dust and mixed with hydrated lime as a spray successfully prevented both feeding and oviposition. Slate dust and hydrated lime were more effective as dusts than as sprays. Preparations containing nicotine did not prevent injury. Further work is essential since the large quantities of sulphur and lime required may have some undesirable effects on the soil over a period of years.

CAGLE (L. R.). **Time of Leaving the Fruit by Oriental Fruit Moth Larvae.**—*J. Econ. Ent.*, xxv, no. 3, pp. 678–681, 1 fig. Geneva, N.Y., June 1932.

An apparatus devised for obtaining continuous data on the times at which larvae of *Cydia* (*Laspeyresia*) *molesta*, Busck, leave the fruit is described. It consists of a light wooden wheel, 37 ins. in diameter and covered with cloth on one side, which is arranged in such a way that it it is caused to rotate in the horizontal plane, with very little friction and practically no play, by means of a weight and system of pulleys.

The wheel is divided by the spokes into 6 equal parts, each of which is entirely surrounded by two strips of aluminium ribbon separated from each other by a rubber band and fastened firmly to the rim and spokes. These serve as electrodes and are connected directly to the light wires, a fuse or light bulb being installed in the circuit as a safeguard against any short-circuit that might occur in the apparatus. Larvae on trying to leave the wheel come in contact with the two electrodes and are either killed or driven back. Strips of corrugated paper are supplied for cocooning quarters.

Infested apples are placed on a piece of glass secured above the wheel. Electrodes of aluminium ribbon are fixed to the upper and lower edges of the glass and connected to the light wires, so that larvae crawling over the edges come in contact with the electrodes and instantly fall. A method is described of regulating, by means of an ordinary alarm clock, the movement of the wheel so that it rotates through one sector every two hours. All larvae dropping within this interval fall in the same sector. In developing the apparatus it was observed that larvae could easily cross a band of tree tanglefoot 1½ inches wide, either when used alone or when diluted with kerosene.

Larvae were removed at 8 a.m. and at 8 p.m. each day, data being obtained on 57 days between 24th June and the end of October. Of the 577 larvae caught, only 3·3 per cent. left the fruit during the day.

The maximum numbers were taken between 4 and 6 a.m. during June, July and August, between midnight and 2 a.m. in September and between 10 p.m. and midnight in October.

SWEETMAN (H. L.). **Further Studies of the physical Ecology of the Alfalfa Weevil,** *Hypera posticus* **(Gyllenhal).**—*J. Econ. Ent.*, xxv, no. 3, pp. 681–693, 3 graphs, 4 refs. Geneva, N.Y., June 1932.

Following a report already noticed, dealing with the physical environment and habits of *Hypera variabilis*, Hbst. (*posticus*, Gyll.) under conditions prevailing in Wyoming [*R.A.E.*, A, xviii, 350], studies on the effects of temperature and moisture on the weevil under field conditions are described. Temperature and relative humidity records were secured at three different levels (2 inches above the ground; at the tops of the plants; and 3½ ft. above the ground), at which all stages of the weevil were maintained in cages. The mean temperature at 3½ ft. from 20th May to 12th July was 16·3°C. [61·3°F.], and at 2 ins. 15·2°C. [59·36°F.], whereas the mean at the tops of the plants from 26th May to 11th July was 16·4°C. [61·5°F.]. The mean humidity, 54·4 per cent., at the lowest level was much greater than at 3½ ft. and was in excess of that, 46·3 per cent., at the tops of the plants. Precipitation, irrigation, wind velocity and sunshine are recorded for the period of the studies. The conclusions drawn from the data obtained confirm those secured in previous seasons [*loc. cit.*].

Daylight temperatures were found to be favourable for oviposition, whereas night temperatures were too low. The hatching of the eggs in the natural environment is probably controlled largely by temperature since they are laid in the stems of the plants. The percentage of eggs hatching, if exposed, is greatly reduced when the relative humidity is below 50 per cent. The incubation periods varied from 9 to 31 days according to the temperature, as the night temperatures were often below the minimum effective temperature for the incubation of the eggs.

Larval development was largely dependent upon temperature since the food furnished ample moisture and the young larvae are not exposed until 7 or 10 days old. The feeding period occupied 23–28 days and the pupal one 10–11. The minimum temperature during the night was often below the minimum effective temperature for development. Freezing temperatures, which killed the plant, apparently did not injure the larvae.

GLASGOW (R. D.). **The White Birch Leaf Mining Sawfly,** *Phyllotoma nemorata* **Fallén in New York.**—*J. Econ. Ent.*, xxv, no. 3, pp. 693–695. Geneva, N.Y., June 1932.

Phyllotoma nemorata, Fall., causes severe injury to white birch [*Betula papyrifera*] in ornamental plantings and in forest areas in northern New York and New England and eastern Canada, and from the rate at which it has spread [*R.A.E.*, A, xvii, 553] it appears likely that it will soon be distributed throughout New York and neighbouring States. White birch is an important element in the succession of plant species, and the depredations of this sawfly may well affect the composition of the future forests over many thousands of acres in New York that were devastated by fire 25 years ago.

P. nemorata has one generation a year in New York, but as it apparently has two in England, it may adopt this habit when it reaches the

central and southern parts of the State. Males are unknown. Though the larvae are said occasionally to develop cannibalistic habits, 2–3 or sometimes even 5 hibernacula may be found in a single leaf. Wherever this pest occurs, its presence may be identified from late September or October to June by its hibernacula in the fallen leaves on the ground.

Caffrey (D. J.) & Worthley (L. H.). **The Status of the European Corn Borer in the United States in 1931.**—*J. Econ. Ent.*, xxv, no. 3, pp. 696–706, 1 ref. Geneva, N.Y., June 1932.

The following is mainly taken from the authors' summary: The most serious spread of *Pyrausta nubilalis*, Hb., discovered in the United States in 1931 was in New Jersey, where infestation was found for the first time scattered over about one-half of the State. Other isolated infestations, situated at considerable distances from the regulated areas, were found in Virginia, Kentucky and Wisconsin. In the north central States area the borer population was about $2\frac{1}{2}$ times that present in the same territory in 1930. This increase was apparently due to the favourable hibernating conditions in the winter of 1930–31, propitious conditions for larval establishment in the summer of 1931 and to the natural reaction to better weather conditions after the drought of 1930. Distinct commercial losses from attack by *P. nubilalis* occurred to field maize in the north-western Ohio district in general and to sweet and field maize in the Lake Ontario district of New York. In the eastern States area, increases in borer population are known to have occurred locally in southern Massachusetts and on Long Island, accompanied by appreciable economic losses to sweet maize.

The best results hitherto obtained in experiments with insecticides applied to maize as a protective control measure have been secured with paraffin oil-lead arsenate combinations, applied as liquids. The application of such materials has been demonstrated to be practically feasible in the case of maize of high market value. Approximately 371,000 additional imported parasites were liberated during 1931, bringing the total number of parasites liberated during the past 12 years to about 4,600,000. Field recovery records indicate total parasitism by the species that have become permanently established as ranging from less than 1 per cent. to 30 per cent. in different localities. Tests carried out to determine the factors affecting resistance and tolerance of the plant to attack by *P. nubilalis* indicated that the rigidity or ruggedness of the stalk played an important part in aiding the high yielding strains to escape with minimum breakage, thus allowing the ears every opportunity for development.

Information obtained during 1931 showed that exposure of fifth instar larvae to —25°F. during 10 minutes effects complete mortality; 12 minutes exposure to —20°F. was fatal; 20 minutes exposure killed the larvae at —10°F.; 150 minutes at 0°F., and 65 hours exposure to 15°F. caused death. Storage for 8 days was required to effect complete mortality when the larvae occupied tunnels in a cob of green sweet maize packed in standard bushel boxes in a cold storage room at 0°F. Establishment of these periods of lethal exposure has a direct application to the commercial processing of green sweet maize, and provides a guide for their sterilization by means of cold for quarantine regulatory work.

Carter (R. H.). **Calcium Fluosilicate Compound is not Calcium Fluosilicate.**—*J. Econ. Ent.*, xxv, no. 3, pp. 707–709. Geneva, N.Y., June 1932.

The material being used by most entomologists in the United States is a complex by-product of phosphate fertiliser containing at most only a small proportion of calcium fluosilicate. The difference between true calcium fluosilicate and this compound is pointed out, and attention is called to the serious confusion that is certain to arise if this incorrect designation is continued. Entomological results obtained with these materials should be reported separately and should not be compared, as they are very different in chemical composition. Analyses and compositions of these materials are shown.

Friend (R. B). **The Control of the Cabbage Maggot** (*Phorbia brassicae* **Bouché**) **on Radishes.**—*J. Econ. Ent.*, xxv, no. 3, pp. 709–712, 1 fig. Geneva, N.Y., June 1932.

Experiments were carried out in May 1931 with *Phorbia brassicae*, Bch., on seedling radishes to test the relative efficiency of mercury bichloride, which is the most commonly used material for the control of this pest in Connecticut though its poisonous properties may prevent its application to radishes, and mercurous chloride, which has previously been shown effective against *P. brassicae* [*R.A.E.*, A, xvii, 447]. A higher percentage of control is necessary on radishes than on cabbage or cauliflower [*cf loc. cit.*] owing to the relatively greater importance of the damage to the root of the former crop than to those of other crucifers. The mercury bichloride was used as a solution of 1 oz. in 10 U.S. gals. water, and the mercurous chloride as an aqueous suspension at the rate of 1 oz. in 10 U.S. gals. and as a dust containing 4 per cent. by weight of the material with gypsum as a carrier, the last being applied to the surface of the soil round the plants or drilled in with the seeds.

In general there was little difference between the treatments, two applications of which appear to be sufficient on radishes. The dust is preferable in view of its cheapness and the ease with which it may be applied. The method of drilling in the material with the seeds appears promising if the difficulty of obtaining an even distribution can be overcome. Mercurous chloride in water settles too quickly to make the application of a suspension efficient and can hardly be recommended. An analysis of the mercury content of the radishes showed a significant quantity in those treated with mercury bichloride, but this is probably of little practical importance. In other cases the amount was insignificant.

St. George (R. A.) & Beal (J. A.). **New Sprays effective in the Control of the Locust Borer.**—*J. Econ. Ent.*, xxv, no. 3, pp. 713–721, 10 refs. Geneva, N.Y., June 1932.

An account is given of experiments in North Carolina during 1928 and 1929 on the control of *Cyllene robiniae*, Forst. (locust borer) on *Robinia pseudacacia*. This Cerambycid has for many years caused considerable damage in the south of the Appalachian Mountains and in the region of the Gulf of Mexico. During 1931 it was found in Texas, New Mexico, Arizona and Washington. Work done on its control in the past 25 years is reviewed from the literature.

Of the various materials tested, the following are recommended: an emulsion of paradichlorobenzene dissolved in pine-tar oil heated to a temperature of 130°F., which was used at a dilution of 1 : 2 and gave 100 per cent. mortality; an orthodichlorobenzene-kerosene emulsion consisting of 1 U.S. qt. orthodichlorobenzene, 1 U.S. qt. kerosene, 1 lb. whale-oil soap and 1½ U.S. gals. water, which was used at a dilution of 1 : 2 and gave 99·1 per cent. mortality; and an orthodichlorobenzene emulsion consisting of 1 lb. whale-oil soap, 1 U.S. gal. orthodichlorobenzine and 1 U.S. gal. water, which was used at a dilution of 1 : 6 and gave 98·1 per cent. mortality. The use of the first has several disadvantages in that the material has to be applied with a brush and stains the bark a dark colour. The other two emulsions are probably the safest, cheapest and most easily applied of all the sprays tested.

The most effective time to apply the sprays was found to be in the early spring about the time the leaves unfold, when the larvae are still present between the bark and the wood. Later applications, after the borers have begun to penetrate the wood, are only partly effective.

CHAMBERLIN (F. S.). **Grasshopper-control Experiments.**—*J. Econ. Ent.*, xxv, no. 3, pp. 722–725, 3 refs. Geneva, N.Y., June 1932.

The results of experiments carried out in north-western Florida from 1926 to 1930 to determine the most efficient bait for the control of grasshoppers, though inconclusive, showed that from the point of view of practical control poisoned bran mash alone (Paris green and wheat bran, 1 : 25 by weight) is an excellent remedy when properly applied.

HOFFMAN (W. A.). *Icerya purchasi* **in Porto Rico.**—*J. Econ. Ent.*, xxv, no. 3, p. 726. Geneva, N.Y., June 1932.

Since October 1931 severe injury has been caused by *Icerya purchasi*, Mask. (cottony cushion scale) to Australian pine (*Casuarina* ? *equisetifolia*) where used for ornamental purposes in San Juan, Porto Rico [*cf. R.A.E.*, A, xx, 401]. Partial control has been obtained by the application of water from a garden hose, relatively low pressure probably preventing better results. It appears probable that *I. purchasi* will become an important pest of this tree, which is the most rapidly growing one on the Island and is a potential source of lumber and of considerable value as a windbreak.

SNAPP (O. I.) & THOMSON (J. R.). **A second Report on the Efficiency of the Air-blast Type of Sprayer.**—*J. Econ. Ent.*, xxv, no. 3, p. 726. Geneva, N.Y., June 1932.

In a second test, carried out in 1931, of the air-blast type of sprayer [*R.A.E.*, A, xix, 104], in which two peach plots received the same materials on 11th April, 15th May and 26th June, lead arsenate being used against curculio [*Conotrachelus nenuphar*, Hbst.] and zinc sulphate for the control of disease, there was 21·7 per cent. more sound fruit in the plot sprayed with the ordinary power sprayer than in that sprayed with the air-blast type of sprayer.

SNAPP (O. I.) & THOMSON (J. R.). **A second Report on the Oriental Fruit Moth Infestation in the Georgia Peach Belt.**—*J. Econ. Ent.*, xxv, no. 3, pp. 726–727. Geneva, N.Y., June 1932.

In continuation of previous work on the extent to which peaches are infested by the Oriental fruit moth [*Cydia molesta*, Busck] in Georgia

[*R.A.E.*, A, xix, 215], examination of fruit from three orchards in 1931 showed only 0·5 per cent. to be infested in one orchard, 0·1 per cent. in another and none in a third.

Essig (E. O.). **The Black Onion Fly, *Tritoxa flexa* (Wiedemann).**—*J. Econ. Ent.*, xxv, no. 3, pp. 727–728, 1 ref. Geneva, N.Y., June 1932.

Larvae of *Tritoxa flexa*, Wied., were discovered in growing chives in California in February 1932. The characters distinguishing them from the larvae of *Hylemyia antiqua*, Mg., which they closely resemble, are quoted. It does not appear to have been definitely determined whether this Ortalid is a primary pest of sound plants or a scavenger, following decay, but the infested chives observed in California were in a decidedly unhealthy condition due either directly to the attacks of the larvae or to previous decay.

Morrill (A. W.). **A Note on the Use of *Trichogramma* Parasites in Orchards.**—*J. Econ. Ent.*, xxv, no. 3, p. 728. Geneva, N.Y., June 1932.

It has been assumed by some investigators that it is necessary to liberate many thousands of individuals of *Trichogramma* to a single tree in orchards in order to obtain practical results in the control of such pests as *Cydia pomonella*, L., and *C. molesta*, Busck.

Instances are quoted to show, however, that the liberation of even a few hundred individuals to a tree may give striking results [*cf. R.A.E.*, A, xx, 424]. Newly devised methods have now made it possible to release 900–1,250 parasites at a cost of 9*d.* a tree, or about 3 times as many as hitherto. This estimate refers to parasites purchased commercially for 1,000–4,000 trees, the cost of the numbers required for less than 1,000 trees being proportionately greater.

Mundinger (F. G.). **A newly observed Insect Pest in Hudson Valley Pear Orchards.**—*J. Econ. Ent.*, xxv, no. 3, pp. 728–729. Geneva, N.Y., June 1932.

Injury to the leaves of the terminal shoots of pear, believed to be caused by *Dasyneura pyri*, Bch. (pear leaf-curling midge), was observed in New York during the latter part of May 1931. The leaves are rolled parallel to the mid-rib and bear at first small, red, gall-like swellings ; they subsequently turn black. Thirty larvae were sometimes found in a leaf. Oviposition on the soft-wooded terminal shoots was observed on 8th June and continued till the middle of August, the eggs being most numerous during June and early July. The incubation period lasted 4–6 days and the larval about 18. Pupation occurred chiefly on the ground and in a few cases in the leaves.

Lime-sulphur at the rate of 1 : 40 killed some of the eggs and at 1 : 8 destroyed all. It is difficult to wet all the eggs owing to their position among the leaf hairs.

Moore (W.). **Reactions of Sulphuric Acid on Sodium Cyanide.**—*J. Econ. Ent.*, xxv, no. 3, pp. 729–730. Geneva, N.Y., June 1932.

The generation of hydrocyanic acid gas for fumigation purposes by means of sodium cyanide and dilute sulphuric acid has very largely been rendered obsolete by the introduction of new materials. However,

small quantities are sometimes required, and the author explains the reason for the surprising results occasionally obtained with this method. When sulphuric acid reacts with sodium cyanide, several gases may be evolved, depending upon the concentration of the acid, the proportions of acid to cyanide and the conditions of the experiment. The gases may be hydrocyanic acid gas obtained from properly diluted acid; mixtures of hydrocyanic acid and carbon monoxide from more concentrated acid; nearly pure carbon monoxide from ordinary concentrated sulphuric acid; mixtures of carbon monoxide, carbon dioxide and sulphur dioxide if the temperature rises during the reaction, and at high temperatures a mixture of carbon dioxide and sulphur dioxide. If the quantity of sulphuric acid is so small that it does not cover the cyanide, some hydrocyanic acid may be evolved along with the other gases. It is therefore not surprising that when strong sulphuric acid and sodium cyanide are used the results are erratic, considered either from the point of view of insect mortality or chemical analyses for hydrocyanic acid gas.

ROARK (R. C.). **The Trend in Pest Control Inventions in the United States.**—*J. Econ. Ent.*, xxv, no. 3, pp. 730–731. Geneva, N.Y., June 1932.

During 1931, 51,766 patents were issued in the United States; of these, 537 related to the control of various forms of pests, including insects, of which roughly 73 per cent. related to mechanical devices and 27 per cent. to chemical products or processes.

MCDANIEL (E. I.). **Carbon Disulphide to control Gladiolus Thrips, *Taeniothrips gladioli* M. & S.**—*J. Econ. Ent.*, xxv, no. 3, p. 732. Geneva, N.Y., June 1932.

Experiments were carried out in Michigan to determine a cheap, effective and harmless method for treating stored corms of *Gladiolus* infested with *Taeniothrips gladioli*, Moult & Steinw. [*R.A.E.*, A, xix, 310]. Dormant corms were placed in muslin sacks and immersed for varying periods in different materials; on removal they were dried, examined for infestation and possible injury and planted in the greenhouse. Immersion for periods between 15 mins. and 5 hrs. in a 50 per cent. miscible carbon bisulphide emulsion (1 : 1,000) not only caused complete mortality of the thrips but stimulated the growth of the plant, but the plants have not yet flowered, and the final results are not known.

MILLER (F. W.). **The Red and Black Cherry Aphid in Massachusetts (Homop. : Aphiidae).**—*Ent. News*, xliii, no. 7, pp. 178–180, 4 refs. Philadelphia, Pa., July 1932.

The author records the finding of *Aphis feminea*, Hottes (*tuberculata*, Patch, *nom. preocc.*) in Massachusetts, on *Prunus serotina*, and gives a description of the alate and apterous viviparous females.

ISELY (D.). **Abundance of the Boll Weevil in Relation to Summer Weather and to Food.**—*Bull. Arkansas Agric. Expt. Sta.*, no. 271, 34 pp., 7 figs., 57 refs. Fayetteville, Ark., May 1932.

Owing to the great variability in abundance and injuriousness from year to year of the cotton boll weevil, *Anthonomus grandis*, Boh., in Arkansas, an investigation was carried out from 1927 to 1931 to determine the conditions during the summer months that are essential

to the development of outbreaks of it. The factors affecting hibernation, which also have a considerable influence on the numbers, are not discussed. The data were secured by rearing weevils at controlled temperatures and humidities. The seasonal history and life-history are discussed, largely from the literature, and the rearing methods employed are described.

The following is taken from the author's summary :—

Favourable climatic conditions shorten the life-cycle to an extent that accounts for the suddenness of outbreaks of the weevil ; nevertheless, unfavourable weather in June and July may reduce the numbers so that potential outbreaks fail to materialise. An increase in temperature from 69·8 to 87·8°F. shortens the cycle from egg to adult by one-half, and an increase from 78·8 to 87·8°F. shortens it by about 20 per cent. The mean temperatures in Arkansas during the critical months of June, July and August are usually within the optimum range for development (77 to 86°F.). Sometimes favourable temperatures are delayed until late June, in which case the fruiting of cotton is delayed correspondingly. After cotton begins fruiting, variations in temperature may accelerate or retard the life-cycle but are never sufficient to change the number of generations occurring during the critical period of cotton production, though they do affect the time of maturity of the first two generations. Boll weevils can survive in large numbers only between 73·4 and 84·2°F., the optimum apparently being 75·2–77°F. A rise in temperature from 77 to 84·2°F. results in an increase in the number of eggs deposited of about 70 per cent., whereas a drop from 77 to 71·6°F. may result in a reduction of about 50 per cent.

An increase in relative humidity from 50 to 90 per cent. consistently hastens development. In the field, the relation of humidity to the rate of development is so overshadowed by the effect of temperature that its importance is not readily recognised. Relative humidity during the summer is the most important factor affecting the survival of immature weevils. The survival of immature stages in squares appeared to be negligible at a relative humidity of 50 per cent., and near optimum at one of 90 per cent. In the field relative humidity is probably never unfavourably high but is often low enough to be distinctly unfavourable. A summer drought therefore often causes potential outbreaks to fail to materialise.

The weevil develops more rapidly in squares than in bolls and more rapidly in small bolls than in large ones. Squares are the only food available in the early part of the reproductive season, and they are far more abundant than bolls for at least 60 days after fruiting begins. Bolls, however, carry the immature weevils through unfavourable seasons because of their retarding effect on development and their resistance to unfavourable temperature and humidity. When climatic conditions are unfavourable to the weevils, the proportion of bolls to squares tends to be greater than under favourable conditions.

At present it is not possible to predict increase of weevils from weather records with any certainty, largely owing to variations in the characters of the plants themselves. Both air and soil temperature and relative humidity are modified by shade, and this becomes increasingly important as the season advances. Drought is the most important factor in checking weevil outbreaks, excessively high summer temperatures and poor development of squares being associated with it.

McDaniel (E. I.). **Some Chewing Insects infesting Michigan Evergreens.**—*Circ. Michigan Agric. Expt. Sta.*, no. 141, 54 pp., 53 figs., 4 refs. East Lansing, Mich., April 1932.

Brief notes are given on the bionomics and control of the chief chewing insects attacking conifers in Michigan, including Lepidoptera, Coleoptera and sawflies. The aim of the circular is to assist municipal foresters and those in charge of private estates, roadside trees or small groves, the matter being largely compiled from the literature.

Hutson (R.). **Red-necked Cane-borer,** *Agrilus ruficollis* **and Raspberry Cane-borer,** *Oberea bimaculata.*—*Quart. Bull. Michigan Agric. Expt. Sta.*, xiv, no. 4, pp. 267–269, 1 fig. East Lansing, Mich., May 1932.

A brief account is given of the Buprestid, *Agrilus ruficollis*, F., and the Lamiid, *Oberea bimaculata*, Ol., both of which have been present in Michigan for a long time past and which have been causing considerable trouble in raspberry plantations during the last two years. The larvae of both these species spend the winter in the canes, and the character of the borings is described to enable identification to be made. Infested canes can be removed in the ordinary course of pruning if care is taken to cut off the deformed canes, and all prunings should be burnt immediately. Canes infested with *O. bimaculata* should be pruned from several inches to one foot below the place where the eggs were deposited. Wild raspberry plants in the vicinity should be removed wherever possible as they frequently harbour the borers.

Sherman III (F.). **Controlling the Codling Moth in southwestern Michigan.**—*Spec. Bull. Michigan Agric. Expt. Sta.*, no. 221, 30 pp., 9 figs., 15 refs. East Lansing, Mich., April 1932.

As a result of experiments and observations carried out during 1929–31 in south-western Michigan various recommendations are made for the control of the codling moth [*Cydia pomonella*, L.] on apples [*cf. R.A.E.*, A, xx, 34].

Allen (T. C.) & Riker (A. J.). **A Rot of Apple Fruit caused by** *Phytomonas melophthora*, **n. sp., following Invasion by the Apple Maggot.**—*Phytopathology*, xxii, no. 6, pp. 557–571, 2 figs., 15 refs. Lancaster, Pa., June 1932.

A new bacterium, *Phytomonas melophthora*, producing a rot in apples has been found in Wisconsin in decaying fruits infested by *Rhagoletis pomonella*, Walsh, and has also been isolated from the larvae and the adults of this Trypetid. The adult fly apparently introduces the bacterium into the fruit with the egg, and the larva, as it burrows, hastens its dissemination.

Smith (R. C.). **A Summary of the Population of injurious Insects in Kansas for 1931.**—*J. Kansas Ent. Soc.*, v, no. 3, pp. 65–91, 1 pl., 9 figs. McPherson, Kans., July 1932.

Notes are given on the prevalence of insect pests in Kansas during 1931, based on data obtained from questionnaires sent out to entomologists, county agents and farmers.

KNOWLTON (G. F.) & JANES (M. J.). **The 1931 Grasshopper Outbreak in Utah.**—*Proc. Utah Acad. Sci.*, ix, pp. 105–108. Salt Lake City, 1932.

This discussion of the injury caused by grasshoppers in Utah in 1931 contains brief notes on the six most important species concerned [*R.A.E.*, A, xx, 37], a list of the others observed with their food-plants, and short accounts of typical outbreaks in areas of severe infestation.

Experiments during July and August with numerous poison baits applied to fields of lucerne and cereals showed this form of control to be more effective than the use of a hopperdozer. The baits were most satisfactory when applied early in the morning, at a temperature of 70–90°F., one of the most effective being composed of 1 U.S. pt. sodium arsenite (4 lb. material), 2 U.S. qts. molasses, 2–3 U.S. gals. water, 25 lb. coarse wheat bran (without shorts) and $\frac{3}{4}$ oz. amyl acetate. The following materials may be employed as substitutes : 1 lb. white arsenic, $1\frac{1}{8}$ lb. unrefined arsenic from the smelters, or 1 lb. Paris green, for the sodium arsenite ; 6 oranges or lemons, for the amyl acetate ; and lucerne meal, for bran. Equal parts of sawdust and bran cost less than bran alone and are almost as effective.

Gryllus assimilis, F., was observed attacking newly transplanted tomato plants on 1st June, and the Tettigoniid, *Steiroxys hendersoni*, Caud., was fairly abundant on wheat, lucerne, oats and barley during July and August.

SORENSON (C. J.). **The Tarnished Plant Bug, *Lygus pratensis* (Linn.) and the Superb Plant Bug, *Adelphocoris superbus* (Uhler), in relation to Flower Drop in Alfalfa.**—*Proc. Utah Acad. Sci.*, ix, pp. 67–70, 1 ref. Salt Lake City, 1932.

An account is given of experiments in Utah during 1930 and 1931 to determine the effect of feeding of *Lygus pratensis*, L., and *Adelphocoris superbus*, Uhler, on lucerne, in view of the annual heavy fall of the flowers. The results, which are given in tables, indicate that though these Capsids cause a certain amount of flower drop, it is likely that other and perhaps more important factors are concerned in this problem.

GREEN (J. R.). **Chemical and physical Properties of Petroleum Spray Oils.**—*J. Agric. Res.*, xliv, no. 10, pp. 773–787, 8 figs., 15 refs. Washington, D.C., 15th May 1932.

In view of the general use of petroleum oils as insecticides, analyses have been made for the purpose of determining what properties of an oil may be used as a guide in estimating the injury that it will cause to plants. Thirteen representative samples of the oils considered most injurious, least injurious and intermediate were used, the most injurious being of the kind generally used as dormant sprays. The samples may be divided roughly into light or highly refined oils, with a sulphonatable portion of less than 16 per cent., and dark or poorly refined oils, with a sulphonatable portion of more than 16 per cent. The methods used to determine the various properties of the oils are described. Injury to plants was estimated by applying the oils to the leaves of barley seedlings, a comparative test showing that the effect on them would serve as some indication of the injury to be expected on apple leaves. The tests show that the oils that produce the most stable

emulsions cause the greatest injury. Only those oils with a suphonatable portion of more than 6 per cent. would, of their own accord, form a film on water, and these are generally the more injurious. There is evidently a close relation between the degree of sulphonation and the ability of the oil to spread and also to emulsify. The colour of an oil is related to plant injury, and the relation of colour parallels closely the relation of the sulphonatable portion. Viscosity, flash point, fire point and density seem to have little relation to the amount of injury caused by oils. Sulphonation undoubtedly removes materials that cause injury to plants, and the sulphonation test is considered to be the best single criterion by which to determine whether a spray oil has objectionable properties, but tests of the effect of complete sulphonation indicate that sulphonation of spray oils is not a complete remedy for plant injury.

As sulphuric acid combines with the more reactive materials, bromine would be expected to do the same. The values for sulphonation and bromination show a relation between the two reactions. Bromine addition is a measure of the unsaturated or multiple bonded compounds. Bromine easily combines at the point of multiple bonds and thus the compound becomes saturated. In other compounds where hydrogen atoms are held loosely, bromine easily takes the place of these poorly attached atoms and becomes fixed in the molecule by the process of substitution. The hydrogen liberated then unites with uncombined bromine, forming hydrobromic acid. Every atomic weight of hydrogen displaced forms a molecular weight of hydrobromic acid. By titration of the hydrobromic acid, it is thus possible to calculate the amount of bromine used in substitution. The compounds that take part in substitution are of the unstable class and may be active in plant injury. The total bromine absorption, minus the bromine used for substitution, is expressed as bromine addition. If the unsaturated compounds of petroleum prove to be the cause of plant injury, the measurement of bromine addition in spray oils will become an important phase of analysis.

The fact that some of the very injurious oils contain only a trace of nitrogen, or none at all, tends to remove any suspicion regarding the injurious effects of nitrogenous compounds. The larger quantities of sulphur in the oils leave their part in plant injury still an open question. The four least injurious oils were found to have a very low hydrogen-ion concentration. As emulsification with water had been shown to be related to injury, a small sample of the most injurious oil was subjected to long continued washing, but this caused 46·1 per cent. injury as against 40·6 per cent. injury from the normal oil. Tests were also made with oils that had previously been treated with various substances, and the loss in weight of barley seedlings after being sprayed with these oils is shown in tables.

Koningsberger (V. J.) & Hart (P. C.). **Proeven ter onderzoek van de periodiciteit in het optreden van de witten topboorder.** [Experiments in the Investigation of Periodicity in the Occurrence of the White Tip-borer.]—*Arch. Suikerind. Ned.-Ind.*, 1932, no. 22, pp. 465–473, 1 fig. Also as *Korte Meded. Proefst. Java-Suikerind.*, no. 7. Surabaya, 1932.

This paper outlines methods to enable planters to ascertain the fluctuations in the abundance of the white sugar-cane tip-borer [*Scirpophaga intacta*, Sn.] in Java.

DE LÉPINEY (J.) & MIMEUR (J. M.). **Notes d'entomologie agricole et forestière du Maroc.**—*Mém. Soc. Sci. nat. Maroc*, xxxi, 195 pp. Rabat, 1932.

This is described as a preliminary account of the pests of plants of economic importance in Morocco, from data compiled during six years' work. In part i (pp. 7–130), brief notes are given on the distribution, food-plants and in most cases the biology of the various pests, almost all of which are insects. Beneficial insects are included but the Coccids are omitted, having been dealt with elsewhere [*R.A.E.*, A, xx, 46]. In part ii, a list is given of the plants, with the names of the pests found on each, the part of the plant attacked being specified. A complete index is appended to each part.

PAPERS NOTICED BY TITLE ONLY.

SEYRIG (A.). **Observations sur les Ichneumonides. (3e Série).**—*Ann. Soc. ent. Fr.*, ci, pt. 2, pp. 111–126. Paris, 30th June 1932.

WALTON (C. L.) & KEARNS (H. G. H.).—**Carabid Beetles as Strawberry Pests in the Cheddar Districts.**—*Rep. Agric. Hort. Res. Sta. Bristol 1931*, pp. 77–82, 4 pls. Bristol [1932]. [See *R.A.E.*, A, xix, 539.]

BALACHOWSKY (A.). **Le pou de San-José** [*Aspidiotus perniciosus*, Comst.] **et l'importation des fruits frais.**—*Rev. Hort. Agric. Afr. N.*, xxxvi, no. 7, pp. 170–176. Algiers, July 1932. [See *R.A.E.*, A, xx, 453.]

MAYLIN (M.). **La courtilière** (*Gryllotalpa* [*gryllotalpa*] *vulgaris*). **Ses ravages. Moyens de destruction.**—*Rev. Hort. Agric. Afr. N.*, xxxvi, no. 7, pp. 181–187. Alger, July 1932. [See *R.A.E.*, A, xix, 657.]

HERING (M.). **Minenstudien 11.** [Studies of Leaf-Mining Insects in Germany, 11.]—*Z. wiss. InsektBiol.*, xxvi, nos. 4–6, 7–10, pp. 93–108, 157–182, 15 figs., 6 refs. Berlin, 1931–32. **Minenstudien 12.**—*Z. PflKrankh.*, xli, no. 11, pp. 529–551, 7 figs., 9 refs. Stuttgart, November 1931.

SHULL (A. F.). **An internal but non-genetic Character affecting Wing Production in Response to Light in an Aphid** [*Macrosiphum gei*, Koch].—*Amer. Nat.*, lxvi, no. 703, pp. 180–183, 3 figs. New York, 1932.

RUSSO (G.). **Il deperimento delle piantagioni di cacao nella Repubblica Dominicana.** [The Decline of Cacao Plantations in the Republic of Santo Domingo.]—*Relaz. Monog. agr.-colon.*, no. 17, 24 pp., 6 figs., 1 map. Florence, 1930. (With a Summary in English.) [See *R.A.E.*, A, xix, 117.]

Records of [235] **Insects and Plant Diseases found at the Plant Quarantine Stations.** [*In Japanese.*]—*Mater. Improv. Agric.*, no. 33 Appendix, 66 pp. Tokyo, Govt. Japan, Min. Agric. For., Bur. Agric., March 1932.

CANDURA (G. S.). **Richerche sulla vita degli insetti e sui danni da essi causati ai prodotti dell'economia rurale o delle industrie agrarie. 2° Contributo. Gl'insetti della camomilla secca e di altre erbe medicinali e industriali disseccate.** [Research on Insects and the Damage done by them to Crops and industrial Products. 2nd Contribution. Insect Pests of dried Camomile and of other medicinal and industrial Herbs.]—*Boll. Soc. Nat. Napoli*, xliii (1931), pp. 343–352, 2 figs., 1 ref. Naples, 15th April 1932.

This second contribution [*R.A.E.*, A, xix, 500] gives an account of the bionomics of *Ptychopoda herbariata*, F. [*cf.* xix, 586], *Ephestia elutella*, Hb., and *Sitodrepa panicea*, L., which attack camomile and other dried medicinal plants in southern Italy.

CANDURA (G. S.). **Osservazioni biologiche sulla** *Tephroclystia pumilata* **Hb., lepidottero geometride che fa seccare i boccioli di rose.** [Observations on the Biology of *T. pumilata*, which causes withering of Rose Buds.]—*Boll. Soc. Nat. Napoli*, xliii (1931), pp. 353–359, 20 refs. Naples, 15th April 1932.

The Geometrid, *Tephroclystia pumilata*, Hb., a pest of roses in Italy, has four overlapping generations a year. In spring, oviposition covers a period of 5–9 days, the eggs hatching 3–12 days later. The larvae enter the rose buds, usually one to each bud, feeding at first on the reproductive organs and later on the petals. When the latter are completely dry, the larvae are mature and pupate among the buds or in the soil. The pupal stage lasts 6–12 days. Unidentified spiders and a species of *Rhogas* attack the larvae. The best means of control is picking off and destroying the buds as soon as they show signs of attack.

TRAVASSOS (L.). **Una specie del genere** *Neoaplectana* **Steiner (Nematoda-Oxyuridae) parassita del** *Conorrhynchus* (*Cleonus*) *mendicus* **Gyll. (Coleoptera-Curculionidae).** [A species of *Neoaplectana* parasitising *C. mendicus*.]—*Boll. Lab. Zool. Portici*, xxvi, pp. 115–118, 2 figs. Portici, 20th June 1932.

The Nematode, *Neoaplectana menozzii*, sp. n., described from Italy, was found in the abdominal cavity of larvae, pupae and adults of the weevil, *Conorrhynchus mendicus*, Gyll., a serious pest of sugar-beet.

SAMOGGIA (A.). **Nota sulla** *Rhagoletis cerasi* **L.**—*Boll. Lab. Ent. Bologna*, v, pp. 22–48, 12 figs., 10 refs. Bologna, 30th June 1932.

The morphology of the adults and mature larva of *Rhagoletis cerasi*, L., are described, with brief notes on the egg and pupa, and its distribution in Europe is reviewed. In Italy it occurs wherever cherries are cultivated, but has not been recorded from Sardinia. In Emilia, where the author carried out observations on it in 1930–32, all the best varieties of cherry are infested, though early ones ripening not later than about mid-May escape oviposition. The adults usually emerge during May. In 1931 a cold spell at the end of April preceded warm weather in May, causing the ripening of the fruits to be delayed, whereas the flies, stimulated by the warmth, appeared 10 days earlier than in 1930. In the laboratory, emergence in 1931 continued from 18th April to 26th May. The adults feed on sugary substances and probably live for 30–50 days. Mating occurs some days after emergence, and oviposition follows 3–8 days later. Eggs may be laid in cherries as soon

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as they show the first signs of ripening. The larva feeds on the pulp, and when full-grown, usually emerges and drops to the ground to pupate, though occasionally pupation occurs in the fruit on the tree. Most of the pupae give rise to adults in the following spring, but some remain in a state of diapause and hibernate twice. The infestation is maintained from year to year chiefly by larvae in cherries left on the trees or on the ground after harvesting.

Good results in control can be obtained by repeated applications of bait-sprays of 1 lb. lead arsenate, 6 lb. molasses and 20 gals. water, provided that the weather is not rainy. Analysis of arsenic on cherries 3–7 days after the last application showed the amount of residue to be harmless to man and animals. The pupae are very resistant to soil fumigation with paradichlorobenzene, but the larvae can be killed by it. At least 8 narrow furrows, 1¼–2 inches deep in loose soil or a little less in compact soil, are drawn with a pointed stick radiating from the base of the tree to the edge of the circle covered by its foliage, and 35–50 gm. paradichlorobenzene are distributed in them. Cultivation of the ground beneath the trees did not give satisfactory results.

FAES (H.), STAEHELIN (M.) & BOVEY (P.). **La lutte contre les parasites de la vigne, champignons et insectes, en 1930 et 1931.**—*Ann. agric. Suisse,* xxxiii, pp. 1–34, 4 figs. Berne, 1932.

The incidence of the vine moths [*Clysia ambiguella,* Hb., and *Polychrosis botrana,* Schiff.] in French Switzerland in 1931 is discussed, and the results of various treatments carried out against them are shown in tables. These demonstrate, as in previous years, the great success of proprietary summer oils as ovicides ; when applied on 4th and 16th June against the first generation, they gave results similar to those obtained with arsenicals. Against larvae 4–5 mm. long, pyrethrum soap sprays gave excellent results, although arsenicals are generally preferred for use on a large scale, on account of their lower cost and because they can be applied before the larvae hatch, thus preventing damage from them. Observations on *Phylloxera* from 1924 to 1931 show that the leaf-gall form is always more or less abundant in a year following one with a hot and dry summer and autumn favourable to the development and survival of the sexuparae. The sporadic appearance of gallicolae in French Switzerland on pure American or hybrid vines does not however constitute any great danger to neighbouring vineyards. *Cnephasia wahlbomiana,* L., which is common on many low-growing plants in Switzerland, has recently been observed to attack vines, the larvae cutting off or girdling the young shoots near the terminal bud. This Tortricid, however, is polyphagous and is only an occasional pest of vines. If it should become more troublesome, it could be controlled by an arsenical spray applied when the buds begin to show.

FAES (H.) & BOVEY (P.). **Le Doryphore du Colorado et la défense de nos cultures de pommes de terre.**—*Ann. agric. Suisse,* xxxiii, pp. 59–70, 8 figs. Berne, 1932.

In view of the danger of the introduction of the Colorado potato beetle [*Leptinotarsa decemlineata,* Say] into Switzerland, an account is given of its occurrence in America and Europe and of its recent establishment and spread in France.

Schwartz (M.). **Der Koloradokartoffelkäfer.** [The Colorado Potato Beetle.]—*Flugbl. biol. Reichsanst. Land-u. Forstw.*, no. 120, 4 pp. Berlin, May 1932.

In view of the possibility of the introduction of *Leptinotarsa decemlineata*, Say (Colorado potato beetle) into Germany, an account is given of its history, bionomics and economic importance, and all stages are described. The situation regarding it in France is reviewed, and a brief account is given of the successful eradication campaigns against it in Germany in 1877, 1887 and 1914.

Pyrethrum-Insektenpulver als Mittel zur Bekämpfung von Kellerasseln. [Pyrethrum Insect Powder as a Control Measure against Woodlice in Cellars.]—*Der prakt. Desinfektor*, xxiv, no. 5, pp. 136 & 141–144. Dresden, May 1932.

Successful laboratory experiments with two proprietary pyrethrum powders against *Porcellio scaber*, Latr., and *Oniscus asellus*, L., are described, 100 per cent. mortality being obtained in all cases. Such dusts are recommended for their control in cellars, in which these woodlice are sometimes very numerous in Germany.

Investigations on the Spike-disease of Sandal. V.—18 pp., 2 figs. Bangalore, Indian Inst. Sci., 1932.

Further experiments by the Forest Research Institute, Dehra Dun, which are described by N. C. Chatterjee (pp. 10–14), were carried out during the quarter ending 31st March 1932 on the possible vectors of spike disease of sandal [*Santalum album*] [*R.A.E.*, A, xx, 373, etc.]. *Sympiezomias cretaceus*, Faust, *Dereodus sparsus*, Boh., and *Myllocerus* sp. fed on sandal plants infected with the disease were still able after 82 days to produce in healthy plants the symptoms of a leaf disease [*loc. cit.*], which are described. The average life of weevils fed on sandal infected with spike disease was shorter than that of those fed on healthy plants. No symptoms of any kind have so far been observed on healthy plants as the result of the feeding of *Moonia variabilis*, Dist., *Petalocephala uniformis*, Dist., and *Sarima* sp. previously fed on infected plants, and it appears improbable that these Homoptera are concerned in the transmission of the disease.

A study was made of the insect fauna of individual sandal trees and of seven of their associated host-plants in healthy and diseased areas in certain forests, and notes are given on the insects suspected as possible vectors of the disease. Thrips and Aphids were found to be entirely absent from *Zizyphus aenoplia* and sandal growing in association ; a disease similar to the spike disease of sandal is common on *Z. aenoplia*, and the entire absence of these insects from this plant is remarkable. The alternative food-plants of various insects attacking sandal are given.

C. Dover (pp. 15–18) indicates briefly some of the data obtained in the course of detailed analyses of the seasonal incidence and relative abundance of the commoner insects in quantitative collections on sandal plots.

PETTEY (F. W.). **The Codling-Moth and Measures for its Control in South Africa.**—*Bull. Dept. Agric. Un. S. Afr.*, no. 108, 36 pp., 9 figs. Pretoria, 1932. Price 6*d.*

This is a revision of a previous bulletin [*R.A.E.*, A, xv, 21] on the control of the codling moth [*Cydia pomonella*, L.] in South Africa, and the recommendations for treatment of apples and pears are partly based on the results of subsequent experiments [xix, 59 ; xx, 267]. Although the cultivation of walnuts is limited to a few groves, the moth is a serious pest in all of them. For its control on these trees spraying with basic lead arsenate (not the usual acid lead arsenate, which severely injures the foliage), 2 lb. to 40 gals. water with the addition of $\frac{1}{4}$ lb. spreader, is recommended. The sprays should be applied with a power sprayer against the newly hatched larvae of the first and second broods, and the first application should not be made until the fruit has set and the earliest signs of infestation are apparent. Probably not more than three applications are justifiable, owing to the size of the trees and the expense involved, the best time for spraying being determined by the catches of moths in bait pans.

Arsenicals cannot be used on apricots as even one application of basic lead arsenate early in the season will result in more arsenic on the fruit at harvest than the regulations allow, and the amount of arsenic per lb. is much increased if, as is usual, the fruit is dried. Two years study, however, indicate that effective control can be obtained by banding the trees late in October and collecting the larvae under the bands regularly once a fortnight from the end of November until the crop is harvested, as well as all infested fruit, and the removal of all loose bark from the trunks and branches, the larvae found under such bark during the winter being destroyed. Kelsey plums are often badly infested in Wellington where no other food-plants except apricots are available. The same measures as for apricots are recommended. In addition it may be possible to apply during October and early November one or two sprays of basic lead arsenate (2 lb. in 40 gals. plus $\frac{1}{4}$ lb. of a spreader containing lime) and avoid the spray residue difficulty, any spray stains being gently wiped off the fruit with a dry, clean cloth at the time it is graded.

SILVESTRI (F.). **The Biological Control of Insects and Weed Pests.**—*J. S.-E. Agric. Coll.*, no. 30, pp. 87–96, 1 portr. Wye, Kent, 12th July 1932.

The author summarises a series of three lectures which he delivered at the University of London in May 1932. In the first, the great losses caused by insects to all crops, stored products, domestic animals, and, by the transmission of disease, to man himself, were emphasised, brief reference being made to artificial control and the biological method being defined and its history related. The inter-relation of parasites and their relation to their hosts were also discussed. In the second, the utilisation of parasites against indigenous pests or ones of foreign origin was dealt with, examples being quoted, and the phases in the organisation and procedure of biological control work were outlined. In the third, the use of insects to pollinate plants and the biological control of weeds were discussed, the programme to be followed in a given project being sketched.

MacDougall (R. S.). **Insect Pests. No. XV.**—*Scot. J. Agric.*, xv, no. 3, pp. 306–314, 16 refs. Edinburgh, July 1932.

An account, largely taken from the literature, is given of the bionomics and control of *Oscinella frit*, L., which is a serious pest of oats in Britain, *Chlorops taeniopus*, Mg., which is typically a pest of barley, though wheat may be attacked, couch grass [*Agropyrum repens*] being the common winter food-plant, *Phorbia* (*Chortophila*) *brassicae*, Bch. (cabbage root fly), *Hylemyia antiqua*, Mg. (onion fly), and *Psila rosae*, F. (carrot fly), the first two being dealt with in greater detail than in the preceding paper of this series [*R.A.E.*, A, xx, 369].

Dawson (R. B.). **Leather Jackets. (A popular Account of the Life-history with Methods of Control.)**—*J. Bd. Greenkeeping Res. Brit. Golf Un.*, ii, no. 6, pp. 183–195, 2 pls., 21 refs. Bingley, Yorks, 1932.

Tipulid larvae occur in grasslands throughout the British Isles and cause severe injury to the turf of golf greens and bowling greens on sandy or other light soils, particularly in southern England and in Ireland.

The biology of *Tipula paludosa*, Mg., is discussed from the literature [*R.A.E.*, A, v, 361, etc.], this species being probably responsible for the greater part of the damage. To stimulate the growth of the turf during infestation it should be rolled and dressed with sodium nitrate at the rate of 1½–2 cwt. an acre. Of the control measures, an emulsion of orthodichlorobenzene has given excellent results in trials, with practically no damage to the turf, and its use is strongly recommended. It is prepared by mixing 16 parts by volume of orthodichlorobenzene, 4 of sodium oleate solution (1 lb. sodium oleate powder dissolved in 1 gal. hot water) and 4 of Jeyes' fluid until a firm paste is obtained, and then adding one more part of Jeyes' fluid. It should be used at a dilution of 1 : 400 and applied at the rate of 1 gal. to 1 sq. yd. of turf at a time when the larvae are near the surface of the soil, the cost for treating 500 sq. yds. being 8–12*s*. The larvae are forced to the surface without being killed and should be swept up. Soaking the surface of the grass with water and leaving tarpaulins on it overnight so that the larvae come to the surface and can be collected may be useful for small level areas or bowling greens. A bait of Paris green [xiii, 533] is suitable for large areas, such as fairways, and may be spread over the turf with a gloved hand prior to a mild, close night, or during damp weather, at a cost of about 7*s*. an acre. As an alternative 1 oz. Paris green and 2 lb. builder's lime to 50 gals. water may be watered over infested areas. The application of naphthalene (2–3 oz. to 1 sq. yd.) mixed with sand to facilitate even distribution, followed by watering, has sometimes been found effective, though the results are variable. The addition of common salt (1 oz. to 1 sq. yd.) to the naphthalene is said to give better results. Using 3 oz. naphthalene, the cost of treating a green of 500 sq. yds. is about 13*s*. Watering with ammonium carbonate (12 per cent.), liquid ammonia (2–4 per cent.) [xv, 8] and ammonium chloride (4 per cent.) is likely to cause damage to turf on golf courses. Satisfactory results are reported from the use of a 0·5 per cent. solution of ammonia applied at the rate of 1 gal. to 1 sq. yd., the cost being 8–12*s*. for 500 sq. yds. of green. In view of success with the use of lead arsenate against other pests in turf [xviii, 272] experiments are being undertaken, broadcasting it over the soil at the rate of 5 or 10 lb. to 1,000 sq. ft.

In one locality its use at the lower rate early in December followed by an application of orthodichlorobenzene emulsion in mid-January reduced the amount of grubs present in 1 sq. yard from 330 to 13. Its use is not advised on greens composed mainly of *Poa annua*. In one instance, promising results were obtained with the use of 1 pt. Jeyes' fluid to 40 or 50 gals. water.

The larvae of various Bibionids, which are, however, less destructive, may be confused with those of the Tipulids. Of these, *Dilophus febrilis*, L. (fever fly) has recently attracted attention and its bionomics are discussed [x, 527, etc.]. No definite information as to its control is available, but the use of naphthalene broadcast over the turf has given fairly good results, and digging this material into open ground has been recommended. When there are relatively few colonies, these may be cut out, and when they are numerous, rolling the turf may be beneficial. It is probable that the emulsion of orthodichlorobenzene would give good results.

Russo (G.). **Informe de entomologia agricola dominicana.** [Report on Agricultural Entomology in San Domingo.]—*Inf. Estac. nac. agron. Col. Agric. Moca*, ii, pp. 33–244, 30 pls., 2 maps. [San Domingo] ? 1927. [Recd. July 1932.]

This report contains a list of the Arthropods harmful to plants, man, and animals that were observed during 1927 in the Republic of San Domingo, showing their distribution and food-plants or hosts. The main section, arranged according to the plants attacked, gives information on the biology of the pests infesting them, with notes on pests of stored products. Some pages are devoted to a discussion of methods for combating ants, local materials suitable as insecticides, biological control, and pests in other countries the introduction of which must be guarded against.

Katsumata (F.) & Sakai (S.). **Experiments in treating Soil for the Control of *Diplosis mori* Yokoyama.** [*In Japanese.*]—*J. Plant Prot.*, xix, no. 6, pp. 428–432. Tokyo, June 1932.

For the control of the Cecidomyiid, *Diplosis mori*, Yokoyama, a pest of mulberry in Japan [*R.A.E.*, A, xix, 261], it is recommended to spray the soil with a creosote emulsion to kill the pupae just before the adults emerge.

Oguro (T.) & Kimura (C.). **An Attempt to control and Field Observations on *Oscinis oryzella* Mats. (Preliminary Report).** [*In Japanese.*]—*J. Plant Prot.*, xix, no. 6, pp. 436–442. Tokyo, June 1932.

Oscinis oryzella, Mats., has been very injurious to rice in recent years in Akita-Ken, Japan, where it also attacks *Zizania aquatica*, being most numerous near the sea shore or lakes. There are two generations a year, hibernation taking place in the pupal stage. The larvae, which are found at the end of May and in July, mine in the leaves. Plants that are widely spaced are preferred. A proprietary derris preparation is recommended for its control.

Schweizer (J.). **Verslag over het jaar 1931.** [Report of the Besoeki Experiment Station, Java, for 1931.]—*Meded. Besoekisch Proefst.*, no. 48, 87 pp. Djember, 1932.

Xyleborus morstatti, Hag. (black twig-borer) was present in numbers on coffee, and measures are being tested against it. Coffee fruits were sprayed with an adhesive with a view to snaring the coffee berry borer [*Stephanoderes hampei*, Ferr.], but none of the materials remained effective for more than a few days. Some individuals of the Uganda borer parasite [*Prorops nasuta*, Wtrst.] were found in infested berries in one plantation, and the breeding and distribution of this Bethylid was resumed there.

Maclagan (D. S.). **An ecological Study of the "Lucerne Flea" (*Smynthurus viridis*, Linn.).**—*Bull. Ent. Res.*, xxiii, pts. 1–2, pp. 101–145, 151–190, 1 diag., 2 maps, 20 graphs, 45 refs. London, March, July 1932.

An account is given of very detailed investigations on the bionomics of *Smynthurus viridis*, L. (lucerne flea) in Britain, undertaken in order to obtain data on the natural controlling factors of this species with a view to ascertaining the significance of predators such as spiders as controlling agents. Its geographical distribution and economic importance are discussed, as well as the methods of investigating environmental factors.

The following is largely taken from the author's conclusions :— The results of the study showed that the most important factor or factors responsible for the unusually high incidence of the pest in Western and South Australia are abnormally favourable conditions of rainfall and temperature, not only in regard to actual climatic conditions, but also in that they prevail uninterruptedly for a longer period and so allow the rate of increase to gather momentum. The greatest density of population in England was found to be 14 individuals to a sq. ft. on 26th June. Details of the density in Australia are not available, but judging from climatic considerations alone, it must be considerably higher than in England, and a figure of twice this amount would give *Smynthurus* the economic status of a serious pest so far as damage to clover is concerned. In order to be able to control this insect on a scientific and economic basis, it is necessary to consider not merely the biotic factors of control but the whole complex of biotic and physical factors, since the latter have a profound influence on parasites, predators and host, resulting in a maze of often unsuspected interrelationships. As regards artificial methods (other than chemical), the investigations have shown that these must centre round a judicious manipulation of the micro-climate, with the object (in this instance) of thereby lowering the humidity and raising the temperature to an extent compatible with the prevailing type of agriculture ; also, the nature of the pest renders feasible direct mechanical treatment with a view to crushing eggs, nymphs and adults, the latter being arranged to fit in, as far as possible, with the routine cultural measures in the husbandry of stock and crop, in order to minimise expense. As regards the more direct ecological relationships, especially the bioclimatic aspect, the author believes that probably the ability to predict outbreaks will eventually be of the utmost assistance in combating this pest. The environmental controlling complex of *Smynthurus* continually

varies in its composition and structure, both spacially and chronologically, and this variation, although continuous, is by no means uniform, and the fluctuations, although often sudden, take place with some degree of regularity when viewed over a period of time, thereby rendering prediction of the organic response a statistically feasible proposition.

Currie (G. A.). **Oviposition Stimuli of the Burr-seed Fly,** *Euaresta aequalis*, **Loew (Dipt. Trypetidae).**—*Bull. Ent. Res.*, xxiii, pt. 2, pp. 191–193, 1 fig., 1 pl. London, July 1932.

Experiments to determine the various factors influencing the oviposition of the Trypetid, *Euaresta aequalis*, Lw., introduced into Australia for the control of Noogoora burr (*Xanthium pungens*) [*cf. R.A.E.*, A, xix, 116, 748], are described. Flies confined with a series of fruits of economic importance failed to oviposit on them. When, however, they were given a branch of *X. pungens*, they immediately began to oviposit in the burrs. It was found that the females react to the odour of their natural food-plant, since when liberated in an insectary containing a number of plants including *X. pungens*, they quickly found this and remained on it. Gravid females confined with green capsules of *Datura stramonium* unsuccessfully attempted to oviposit on them, the absence of hooks on the tips of the spines appearing to prevent them from obtaining the firm foothold required to pierce the hard coating of the capsule. They also behaved in a similar manner when placed on the spiny surface of the bracts behind a sunflower head. Females did not attempt to oviposit on green burrs of *X. pungens* that were stripped of their spines, but tried to do so on artificial (rubber) ones covered with hooked pins to represent spines. It is thought probable that the shape of the burr may have some effect in stimulating oviposition, since the flies showed little interest when placed on the flat surface of a cork studded with hooked pins.

Miller (N. C. E.). **Observations on** *Melamphaus faber*, **F. (Hem., Pyrrhocoridae) and Descriptions of early Stages.**—*Bull. Ent. Res.*, xxiii, pt. 2, pp. 195–201, 3 figs. London, July 1932.

An outbreak of the Pyrrhocorid, *Melamphaus faber*, F., occurred on *Hydnocarpus anthelmintica* and *H. wightiana* on an experimental plantation in Malaya early in January 1931, the bugs having probably migrated from a jungle about ¾ mile away. All its stages are described. A marked preference was shown for the fruits of *H. anthelmintica*, owing probably to the fact that the bugs encountered less difficulty in piercing the outer rind, which is only 2 mm. thick and less woody than that of the fruits of *H. wightiana*. No alternative food-plants were observed. In the laboratory both Nitidulids (*Carpophilus* sp.) and Drosophilids were bred from fruits attacked by the bugs, and it is probable that *M. faber* is indirectly responsible for premature fruit fall, which was above normal during the infestation, since by injuring the fruits it affords ingress to the beetles and favourable sites for oviposition for the flies. The larvae of the flies by further injuring the fruits cause decomposition. The eggs of this bug are laid in loosely adhering masses of 110–180. Only one batch of eggs was observed in the field; it was found on 23rd January, deposited in a small cavity on the south-west side at the base of a tree. It is probable that in less sheltered situations the females cover them with soil. Second instar nymphs were found

on 27th January and at that time appeared to be two days old. By 17th January the bugs had become less numerous. This was due partly to natural causes and largely to spraying with a kerosene emulsion and a pyrethrum solution. In addition, large numbers were collected daily and destroyed. This species occasionally attacks its own eggs, and a female was observed feeding on a fourth instar nymph. Mortality among the eggs and nymphs in the field is probably very high, since although adults were abundant and the number of eggs deposited by them probably large, very few nymphs were present during mid-March. Little is known regarding the natural enemies of *M. faber*, which owing to its objectionable smell is probably rarely attacked by birds or mammals. Five puparia of an unidentified Tachinid were obtained from a total of about 250 adults captured in the field. The larvae of this fly leave their host just before pupating, the pupal period lasting about 14 days.

PICKLES (A.). **Notes on the natural Enemies of the Sugar-cane Frog-hopper** (*Tomaspis saccharina*, **Dist.) in Trinidad, with Descriptions of new Species.**—*Bull. Ent. Res.*, xxiii, pt. 2, pp. 203–210, 3 figs., 16 refs. London, July 1932.

In investigations in Trinidad during 1930–31 on the egg-parasites of *Tomaspis saccharina*, Dist., soil samples containing the eggs were as far as possible collected from the same fields, and the eggs isolated by a method already described [*R.A.E.*, A, xx, 94]. The new egg parasites described are the Mymarid, *Anagrus urichi*, and the Trichogrammatid, *Abbella tomaspidis*. The latter was only found on three occasions, whereas *A. urichi* was frequently observed, but it was never sufficiently abundant to exert an appreciable check on the pest. Usually 3 individuals develop in each host egg. Although the Mymarid, *Oligosita giraulti*, Crwfd., has been observed by other workers attacking *T. saccharina*, and was once found parasitising from 5 to 10 per cent. of eggs collected from grass, none of the 10,000 eggs collected from cane estates during this survey was found to be attacked by it. Investigations on the Syrphid, *Salpingogaster nigra*, Schin., the larvae of which are predacious on *Tomaspis*, showed that during July it was present in numbers only on two estates and its occurrence did not become general until August-September. In October, however, it began to decrease rapidly. It was thus only of importance during the third brood of *Tomaspis* in most localities. This fly on two occasions was found associated with spittle-masses of *T. pubescens*, F. An undetermined species of jumping spider has frequently been observed to attack adult frog-hoppers.

SALT (G.). **Superparasitism by** *Collyria calcitrator*, **Grav.**—*Bull. Ent. Res.*, xxiii, pt. 2, pp. 211–216, 4 refs. London, July 1932.

The following is taken from the author's summary: It has been assumed that parasites oviposit in their hosts purely at random, not discriminating between healthy hosts and those already parasitised. Only one individual of the Ichneumonid, *Collyria calcitrator*, Grav., can develop in *Cephus pygmaeus*, L. (wheat-stem sawfly), so that parasites of this species ovipositing in hosts already parasitised endanger or doom their progeny. Of 3,761 larvae of *C. pygmaeus* examined in England, 1,049 were unparasitised and 2,712 were parasitised by

C. calcitrator ; 2,195 contained one, 332 two, 98 three, 49 four, 18 five, 7 six, 4 seven, 5 eight, 2 nine, 1 eleven, and 1 sixteen parasites. These data do not agree, even when corrected for several factors, with the values expected from random distribution of the eggs one at a time, and indicate a degree of discrimination on the part of the ovipositing females.

An appendix by R. H. Stoy gives formulae by means of which it is possible to calculate mathematically the most probable distribution of the eggs among the hosts, on the assumption that they are laid at random, one at a time.

Le Pelley (R. H.). **On the Control of *Antestia lineaticollis*, Stål (Hem., Pentatom.) on Coffee in Kenya Colony.**—*Bull. Ent. Res.*, xxiii, pt. 2, pp. 217–228, 1 pl., 10 refs. London, July 1932.

The Pentatomid, *Antestia lineaticollis*, Stål, is one of the most serious pests of coffee in Kenya. The injury it causes is briefly described, with notes on its life-history and natural enemies [*cf. R.A.E.*, A, vii, 405 ; ix, 563]. Of the control measures employed, contact sprays have proved of little value, but hand collection of the bugs and egg-clusters and liberation of the parasites are widely practised and although expensive, are of considerable value. The inconsistent results obtained from the application of a bait-spray [xvii, 626] are considered to be due to the fact that the parasites of *Antestia* are also killed by it. An account is given of an investigation on the effect of this spray on the fauna of coffee plantations [*cf.* xx, 117]. On one estate where this spray had been used fairly frequently for 18 months, the number of individuals and species of Coccids present was considerably greater than on an adjacent one where *Antestia* has been controlled by hand-collection. A serious attack of *Leucoptera coffeella*, Guér., which is parasitised in the larval and pupal stages and is very rarely of any importance in the Colony, also occurred on this estate following several applications of the spray. In rainy districts this spray is less effective than in drier ones, and its use is only recommended if a dry period of 4–5 days can be predicted with any certainty. Moreover, if one or two applications prove ineffective it may be advisable to resort to hand collection, returning to spraying if desired.

Jolles (P.). **A Study of the Life-history and Control of *Cerambyx dux*, Fald., a Pest of certain Stone-fruit Trees in Palestine.**—*Bull. Ent. Res.*, xxiii, pt. 2, pp. 251–256, 2 pls., 2 refs. London, July 1932.

The Longicorn beetle, *Cerambyx dux*, Fald., the immature stages of which are described, is a serious pest of apricots, peaches and almonds in Palestine. In the environs of Jerusalem it has been allowed to establish itself over a long period and to such an extent that, unless immediate control measures are undertaken, peaches and apricots will eventually disappear from these localities. Adult emergence occurs from about mid-May to about mid-June. The eggs are laid singly in wounds and crevices of the trunk and main branches and especially on frass under dead bark, 30–40 being deposited by one female. Eggs exposed in the insectary to sunlight failed to hatch. Trees under 8 years old, unless wounded, are seldom attacked, since their bark is too smooth to offer sufficient protection for the eggs. The larvae at first feed on the bast and cambium and later bore into the wood itself,

making irregular tunnels, which seldom extend lower than about 2 ft. from the ground. The most heavily attacked part of the tree is usually found at the crotch and below it, and during serious infestations it is riddled with larval borings, and frequently a strong wind breaks a branch, thus exposing the larval burrows. From 30 to 50 larvae of all stages may be found in a heavily infested tree. A secondary attack by *Scolytus amygdali*, Guér., may follow, frequently resulting in the death of the trees. During the winter months, from December till the end of February, the activity of the larvae is at its lowest. The quantity of sap within the tree has a great influence upon the development of the larvae and beetles. If a tree dies when the larvae present in it are one year old, they give rise to much smaller adults. Pupation occurs in tunnels running parallel, or at an angle of 45 degrees, to the axis of the trunk. The lengths of the various developmental stages were: egg 1–3 weeks (during May-June); larval, 15–16 months (from June to August-September of the following year); pupal, 1–2 months (during August-November); and dormant adult stage within the pupal cell, 7 months (from November–May).

For control, all dead bark should be removed, as well as all frass from tunnels thus exposed, care being taken not to wound the trees. The holes should then be stopped with cement, before the end of April, in order to prevent the emergence of the adults, or the entry of other insects and fungi, and to compel the larvae to bore fresh outlets for the frass, thus indicating their position in the trunk. All pieces of dead bark and frass should be removed and destroyed. All new borings should be treated with 1–2 cc. of carbon bisulphide, applied by means of an oil can with the needle of a hypodermic syringe fixed to the end of the delivery tube, and the holes closed with grafting wax. Whitewashing the trunks appears to repel the ovipositing females. All dead heavily infested trees should be felled and removed from the orchard, and the trunks cut up into small pieces to prevent the larvae from completing their development.

The technique employed in breeding the beetles is described.

Myers (J. G.). **The original Habitat and Hosts of three major Sugar-cane Pests of Tropical America** (*Diatraea, Castnia* **and** *Tomaspis*). —*Bull. Ent. Res.*, xxiii, pt. 2, pp. 257–271, 1 pl., 8 refs. London, July 1932.

The following is mainly taken from the author's summary :—

A study has been made of the small moth-borers of sugar-cane, *Diatraea* spp., *Castnia licoides*, Boisd. (giant moth-borer), and *Tomaspis saccharina*, Dist. (sugar-cane froghopper) in their respective primitive environments, with a view to finding new parasites for them and to obtain light on their ecology under agricultural conditions. The original food-plants of *D. saccharalis*, F., were found to be certain aquatic and semi-aquatic grasses growing at the edge of forest creeks in the Orinoco Delta and of rivers flowing through the Venezuelan llanos (plains), and in lakes of the Greater Antilles. In the llano habitat *D. busckella*, Dyar & Heinr., and *D. impersonatella*, Wlk., were found under indubitably primitive conditions. The original food-plants of *D. canella*, Hmps., another pest of sugar-cane, include two forms of *Paspalum millegrana* growing on the Trinidad littoral. *Castnia licoides* occurs on the Musaceous plant, *Heliconia bihai*, in the forests of Trinidad, the Orinoco Delta and north-western British Guiana. It is much more abundant in scattered clumps growing in high forest than

in solid " reefs " of the plant in more recent clearings. *T. saccharina* is definitely shown to be originally a forest insect. The swamps and savannahs of Trinidad were not found to afford a breeding-ground for any of the three major pests discussed.

UVAROV (B. P.). **Ecological Studies on the Moroccan Locust in Western Anatolia.**—*Bull. Ent. Res.*, xxiii, pt. 2, pp. 273–287, 6 figs., map, table, 7 refs. London, July 1932.

Dociostaurus maroccanus, Thunb., occurs in its solitary phase practically throughout the whole of Asia Minor, except the very humid zone along the Black Sea coast and in the higher mountains. There are, however, only two main regions of the Peninsula that are subject to periodic invasions by locust swarms. One comprises the south-eastern provinces of Turkey and represents only a part of a much greater area extending into the adjoining parts of Syria, Iraq and Persia. The second region occupies the whole western extremity of the Peninsula.

These studies, which were undertaken in the latter region in 1931, aimed at the discovery of reservations, or the localities in which locusts survive in considerable numbers, even during the years of minimum, and where the conditions are suitable for the production of the swarming phase. Not less than eight localities of this kind were found, all of them being situated between about 1,640 and 3,280 ft. above sea-level on the slopes of the central plateau facing the Mediterranean or on the slopes of the mountain ridges separating river valleys. With regard to the vegetation, all the reservations are well above the zone where the cultivation of olives is practicable, very close to the upper limit of the Valonia oak (*Quercus aegilops*) and immediately below the lower limit of the grass steppes occupying the inner high plateau of the Peninsula. Though the reservations occur within a fairly definite zone, the whole of that zone does not represent a potential breeding-ground for the swarming phase of the locust. It was found that its oviposition requirements are extremely narrow, and the spots selected for oviposition are characterised by a very scanty xerophilous vegetation in which a dwarf species of *Plantago* plays a prominent rôle, so that this plant can be considered an indicator of possible reservations. Another important plant is *Cynodon dactylon* which, like *Plantago*, grows on the barest spots, over which it spreads its creeping stems. Locust eggs were found concentrated close to it.

There are two main climatic regions in Asia Minor. One of these is the steppe region of the plateau, where the annual precipitation is about 8–20 ins., most of which falls in spring ; the other comprises the plains and lower hills of western Anatolia, where the precipitation varies between 20 and 40 ins., most of it falling during the winter months. The precipitation of the reservation zone is intermediate between these two, and is characterised by great variation from year to year.

For the comparative analysis of environmental conditions in different areas and years a bioclimatograph is used. This is a variation of the usual Ball-Taylor climatograph, in which the lines connecting the monthly points are made to represent the stages in which the insect passes the respective months. Such an analysis showed that the critical stage is probably the egg-stage and that the controlling factor in the plains is the very abundant winter rainfall combined with high

temperature, which may cause the eggs to hatch prematurely. The factor controlling locusts on the plateau is probably spring frosts, but the available data are not yet sufficient for a definite conclusion.

The general climatic conditions both on the plains and on the plateau are inimical to an increase in the numbers of the locust. The great instability of climatic conditions in the reservation zone, which cause sharp fluctuations in locust numbers, appears to be of exceptional importance in the production of the swarming phase. These fluctuations would naturally result, in favourable years, in the crowding of locusts within restricted spots, and the swarming phase would be produced. The density of the locust population would be, moreover, affected both by the actual increase or decrease in the numbers, and by the expansion or contraction of spots with typical vegetation dependent on the climatic fluctuations.

As a general principle, it is concluded that the instability of the critical factor constitutes an important character of the reservations, while the invasion zones are characterised by a more equable regime, permitting locusts to exist in them for considerable periods, but without increasing in numbers.

From the practical point of view, a continuation of the survey of the existing reservations, a study of their ecology and especially the climate, and the keeping of all reservations under observation for the control of all incipient congregations of locusts and prevention of outbreaks are recommended.

Staniland (L. N.) & Walton (C. L.). **The Control of Capsid Bugs on Black Currants. Field Experiments in 1931.**—*Rep. Agric. Hort. Res. Sta. Bristol 1931*, pp. 83–88. Bristol [1932].

An account is given of further experiments, carried out in January and February 1931 at two centres in the west of England, with a high boiling neutral tar oil-heavy paraffin wash against *Plesiocoris rugicollis*, Fall., and *Lygus pabulinus*, L., on black currants [*cf. R.A.E.*, A, xviii, 626]. The heavy paraffins used were " White " oil (specific gravity at 60°F., 0·86 ; viscosity, Redwood 1 at 70°F., 125; iodine value, 1·1 ; and flash point (open), 310°F.) and " Half White " oil (specific gravity, 0·875 ; viscosity, 160 ; iodine value, 7·6 ; and flash point, 310°F.). The results confirm conclusively those previously obtained [xviii, 627] and indicate that mixtures of equal proportions of tar oil and heavy paraffin oil, at a strength of 10 per cent., give practically complete control of the Capsids. The apparent decrease in toxicity when the constituents were used at the same strength but at the rate of 1 part tar oil to 3 of heavy paraffin oil is unexpected, as the latter material was indicated to be the main agent toxic to the eggs. The mixture, at the rate of 1 : 1 or 1 : 3, was unsatisfactory at a strength of 6 per cent. The paraffin oils alone at a strength of 5 per cent. were effective against the Capsids, but the use of the tar oil-heavy paraffin mixture was necessary when the control of Aphids was also required. The " Half White Oil " was as effective as the " White Oil " and was cheaper. The tar oil alone at a strength of 10 per cent. gave some control but was not sufficiently effective for commercial use. Rain, which fell soon after the application of some of the treatments, had relatively little, if any, effect on the results. This is contrary to general experience with ordinary tar oil sprays. No damage to buds or foliage by the sprays used was noticed.

Staniland (L. N.) & Walton (C. L.). **Field Trials of Tar Distillate-Heavy Paraffin Washes for Apple Capsid Bug** (*P. rugicollis*) **Control (Season 1930–31).**—*Rep. Agric. Hort. Res. Sta. Bristol 1931*, pp. 89–100, 2 refs. Bristol [1932].

In view of the successful preliminary results obtained with a tar distillate-heavy paraffin wash against Capsids on black currants [*R.A.E.*, A, xviii, 626], experiments were carried out during the season 1930–31 to test the efficacy of this type of wash against *Plesiocoris rugicollis*, Fall., on apples. The " high-neutral " tar distillate wash was combined with " White " and " Half White " heavy paraffin oils [see preceding paper], and these were contrasted with the " high-neutral " type of wash previously employed [*cf.* xix, 607, etc.]. The sprays were applied at a strength of 10 per cent. in January and February. The trials, which were carried out at six centres, were hampered by adverse spraying conditions, loss of crop through unfavourable weather at the time of flowering, and severe attacks of the apple sawfly [*Hoplocampa testudinea*, Klug] at several centres where there was fruit.

The following is taken from the authors' summary : In general, the results with the tar distillate-heavy paraffin washes were promising and superior to those obtained with the " high neutral " wash. At several centres the " high neutral " wash failed to give commercial control. The two types of paraffin oil were generally about equally efficient, though some variation in individual results occurred. Where two separate applications were made, at the beginning and end of February, the later application was the more effective. Damage to the buds was noticed at two centres but was not serious. The amount of " late " fruit marking by the Capsid was less than in the previous year. Migration from untreated interplanted black currants is suggested as a possible cause of the unsatisfactory results on the adjacent trees at one centre. The manner in which the eggs were laid showed no apparent relation to the degree of control obtained.

Swarbrick (T.) & Thompson (C. R.). **Observations upon the Incidence of " Reversion " and the Control of " Big Bud " in Black Currants.**—*Rep. Agric. Hort. Res. Sta. Bristol 1931*, pp. 101–111, 1 diag., 2 refs. Bristol [1932].

Investigations on the incidence of reversion in black currants [*cf.* *R.A.E.*, A, xv, 482], carried out during the first four years after the planting of the bushes, showed that this disease is capable of spreading in the absence of insect pests or of the black currant mite [*Eriophyes ribis*, Nal.], the cause of big-bud. Successful control of this mite was obtained by a routine application each spring of lime-sulphur (1 : 12).

Kearns (H. G. H.) & Swarbrick (T.). **Some Observations on the Control of the Apple Sawfly** *Hoplocampa testudinea* **(Klug).**—*Rep. Agric. Hort. Res. Sta. Bristol 1931*, pp. 112–117, 1 ref. Bristol [1932].

Hoplocampa testudinea, Klug (apple sawfly) has become of increasing importance as a pest of apples in the south-west of England during the past few years and caused serious crop losses in some varieties in 1931.

Preliminary experiments showed that satisfactory control of the larvae before they enter the fruit can be obtained with a spray of

8 fl. oz. nicotine (98 per cent.), 2½ lb. Agral I (which equals 0·25 per cent. solution) and 100 gals. water, applied at a pressure of 160–180 lb. per sq. in. between the 3rd and 8th day after the fall of the petals. The latter was taken as the period when most of the petals fell if the branches were tapped. The infestation was reduced from over 54 per cent. infested fruit on the unsprayed trees to less than 13 per cent., the lowest infestation (5·6 per cent.) being obtained by spraying on the 5th day after petal fall. The total yield of fruit from 12 unsprayed trees was 209 lb. as against a minimum of 500 lb. and a maximum of 724 lb. from the sprayed ones.

Tutin (F.). **A Note on the Toxicity of Mineral Oil Sprays to Vegetation.** —*J. Pom. Hort. Sci.*, x, no. 2, pp. 65–70. London, June 1932.

The following is the author's abstract : It is shown that the iodine value, as determined by the Hüble or Wijs method, may be taken as an index of the toxicity of a mineral oil towards vegetation. The iodine value of an oil is more easily estimated than is the unsulphonatable residue and appears to give information of equal value. The conclusion is drawn that it is not safe to use an oil having an iodine value greater than 1·0 for the preparation of a summer spray mixture having an oil content of 3 per cent. It is impossible, however, to state positively that every mineral oil having an iodine value of 1·0 or less will be safe for use on growing vegetation. It is pointed out that caution is necessary in choosing the method of emulsification of an oil spray, as damage to foliage may result from the use of an unsuitable emulsifier even with a non-toxic oil

Massee (A. M.). **Some injurious and beneficial Mites on top and soft Fruits.**—*J. Pom. Hort. Sci.*, x, no. 2, pp. 106–129, 33 refs. London, June 1932.

An attempt is made to bring together from the literature known facts concerning the biology and control of mites attacking fruit trees, walnut, *Corylus*, bush-fruits and strawberries in Britain, in order to render them accessible for reference purposes. Certain original observations and recommendations are added, and brief reference is made to certain species occurring in other countries that are likely to be introduced into Great Britain. A number of beneficial mites are dealt with under the plants on which they occur.

Edwards (E. E.). **Winter-Spraying Trials in the West Midlands.**—*J. Minist. Agric.*, xxxix, no. 5, pp. 411–420, 2 pls., 4 refs. London, August 1932.

Reports have been received that spraying with Long Ashton tar oil alone [*R.A.E.*, A, xvii, 120, 673] or combined with a heavy paraffin or mineral oil [xviii, 626 ; xix, 246] has failed to control Capsid Bug [*Plesiocoris rugicollis*, Fall.] on apples and has often resulted in considerable reduction of fruit spurs on certain varieties. Investigations showed this to be due to incorrect timing, faulty methods and the application of unsuitable materials.

However, in view of considerable evidence in support of the complaints, experiments were undertaken with the primary object of comparing the efficiency of certain washes capable of destroying the eggs of *P. rugicollis*, apple sucker [*Psylla mali*, Schmidb.], Aphids and

the winter moths under conditions in the western Midlands. Of eight different washes applied from the 18th to 25th February, one consisting of mineral oil emulsion and modified Long Ashton tar oil wash (2 : 1), at a concentration of 12½ per cent., proved the most effective as a general winter wash for the control of insects on apple trees on which *P. rugicollis* is present ; no injury was caused to the buds or to gooseberry bushes growing beneath the trees.

Austin (M. D.), Jary (S. G.) & Martin (H.). **Studies on the Ovicidal Action of Winter Washes, 1931 Trials.**—*J. S.-E. Agric. Coll.*, no. 30, pp. 63–86, 8 refs. Wye, Kent, July 1932.

With a view to the ultimate standardisation of oils for dormant sprays, experiments were undertaken in England in 1931 to determine what particular physical and chemical properties are correlated with efficient ovicidal action. Attention was primarily directed to the " stifling " action of the oils [*R.A.E.*, A, xviii, 496], and the characteristics taken into account were volatility, viscosity and reactivity (the tendency of the oil to undergo chemical change to form derivatives easily removed by the influence of weather), on which the permanence of the oil film over the eggs appears to depend. The washes were prepared from various oils and proprietary preparations, the analyses of which are discussed. The methods of emulsification are described, Agral WB or, in most cases, oleic acid being employed [*cf.* xvii, 673 ; xix, 612, etc.]. The development of a fuller technique for the analysis of proprietary hydrocarbon washes has made possible an attempted correlation of biological performance and analytical data.

In laboratory trials of ovicidal efficiency, twigs of red currant heavily infested with eggs of *Lygus pabulinus*, L., were immersed in the mixture and, having been dried on a rack for 1½ hrs., were exposed to the weather in moist sand, in which they took root. The following conclusions were reached : Sprays containing 6 per cent. tar oils are inferior to those containing either 10 per cent. tar oils, 6 per cent. vegetable oils or 6 per cent. petroleum oils ; those containing 10 per cent. tar oils are equal in action to those containing 6 per cent. vegetable oils and inferior to those containing 6 per cent. petroleum oils ; and those containing 6 per cent. vegetable oils are inferior to those containing 6 per cent. petroleum oils. The efficiency of the washes containing 6 per cent. petroleum oils is sufficiently great to show no improvement at a concentration of 10 per cent. or with the addition of tar oils or petroleum jelly. Tetralin at 6 per cent. is markedly inferior in ovicidal properties to the tar oil at the same strength, a difference which may be correlated with the lower boiling range of tetralin (205–215°C.). Eggs of *Cheimatobia brumata*, L., deposited on twigs of apple and hawthorn in muslin cages, were sprayed with the washes, then drained and dried and placed in receptacles in the laboratory until the completion of hatching. The results indicate that petroleum oils at 6 per cent. are as effective in preventing hatching as tar oils at 6 per cent. and that, when emulsified by means of oleic acid, the ovicidal action is not less than when emulsified with Agral WB.

In field trials mixtures of 4 per cent. tar oil and 6 per cent. semi-refined light lubricating petroleum oil or refined petroleum oil, water-white in colour, gave good control of *Plesiocoris rugicollis*, Fall., on apples and of *L. pabulinus* on black currants and caused no injury to the trees or bushes. The application of washes of 8 per cent. semi-refined

petroleum oil; 4 per cent. tar oil and 4 per cent. semi-refined petroleum oil; and 4 per cent. tar oil, 4 per cent. semi-refined petroleum oil and 1 per cent. petroleum jelly gave satisfactory control of Aphids, apple sucker [*Psylla mali*, Schmidb.] and *C. brumata* on apple and caused no injury to the trees. Capsids were not present. A wash of 4 per cent. tar oil, 4·8 semi-refined petroleum oil and 1·2 per cent. petroleum jelly gave a good control of *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.) on apples and *Eriophyes pyri*, Pag., on pears, without injury to the trees. Washes of 6 per cent. water-white petroleum oil; 6 per cent. semi-refined petroleum oil; 4 per cent. tar oil and 6 per cent. water-white petroleum oil; and 4 per cent. tar oil, 4·8 per cent. water-white petroleum oil and 1·2 per cent. petroleum jelly failed adequately to control *Plesiocoris rugicollis* on apple, but did not injure the trees. Proprietary Long Ashton two-solution washes (1 : 10) and one-solution washes (1 : 8) gave a satisfactory control of *P. rugicollis* on apples and caused no injury to the trees. Proprietary washes containing tar or petroleum oils or both were applied at a dilution of 1 : 10 to apples, and an attempt made to correlate the ovicidal effect with the composition of the wash. It is possible to advance tentative explanations of the poor control of *P. rugicollis* given by two of the washes, but in other cases, little difference in the degree of control was obtained, despite differences in oil content and type of oil.

Information is appended on further developments of analytical technique which have been applied to the combined tar oil-petroleum oil preparations in order to obtain an idea of the relative content of tar and petroleum oils [xix, 322].

JARY (S. G.). **The Strawberry Blossom Weevil** *Anthonomus rubi* **(Herbst).**—*J. S.-E. Agric. Coll.*, no. 30, pp. 171–182, 9 figs., 24 refs. Wye, Kent, July 1932.

An account is given of further investigations on *Anthonomus rubi*, Hbst., carried out in Sussex and Kent in the field and the laboratory during 1930–31 [*cf. R.A.E.*, A, xix, 611]. All stages are described. This weevil occurs throughout Great Britain, the heaviest damage to strawberry being done in the southern counties. The early blossoming varieties are less severely attacked than the later ones. It has also been recorded from raspberry, blackberry, rose and *Potentilla*. Under both field and laboratory conditions the egg stage lasts 7–8 days, the larval 24–38 and the pupal 11–12. Under experimental conditions, weevils taken from cultivated strawberries fed and bred readily on wild strawberries and some other weeds and *vice versa*.

Parasites were scarce in the area under observation, only a single individual of an unidentified species of *Habrocytus* being obtained. From 70 infested buds collected in Devonshire in 1930, 12 examples of *Microbracon immutator*, Nees, emerged.

JARY (S. G.). **Pyrethrum.**—*J. S.-E. Agric. Coll.*, no. 30, pp. 183–185, 1 fig. Wye, Kent, July 1932.

An account is given of the cultivation during 1931 of a half-acre plot of pyrethrum (*Chrysanthemum cinerariaefolium*). It appears that this crop can be grown successfully under suitable conditions in England but that investigations are necessary to improve the methods of harvesting and drying and to reduce their cost.

THOMAS (R.). **Periodic Failure of the Punjab-American Cotton Crop.**—*Agric. & Live-stock in India*, ii, pt. 3, pp. 243–274, 3 pls., 1 diag., 11 refs. Calcutta, May 1932.

The American varieties of cotton grown in the Punjab sometimes become affected with an undetermined disease, with the result that the loss in a year of general crop failure may exceed £5,000,000. This disease was fairly common throughout the Province in the years 1919, 1921 and 1926-28. The symptoms, which are described, are associated with plants in the maturing stage, during October-November. Some earlier theories advanced by other workers to account for the loss of the crop and factors believed to influence the intensity of the damage are discussed. The author considers that the Aleurodid, *Bemisia gossypiperda*, Misra & Lamba, is the basic cause of these periodic failures, and notes are given on its distribution and bionomics [*cf. R.A.E.*, A, xix, 253, etc.]. With the exception of the premature reddening of the leaves and premature defoliation, all the symptoms associated with the destruction of the crop were reproduced in cage experiments with a normal infestation of this Aleurodid. With a heavy infestation the symptoms were accentuated and no viable seed was produced. When, however, the insect was eliminated from the cages by spraying, boll production was greatly increased and the percentage of prematurely opened ones reduced.

The incidence of *Bemisia* is probably largely controlled by rain, particularly if the showers are heavy and are well distributed during May–August, and also largely by predators and parasites. Among a number of dusts and sprays tested against it, a resin-soda spray gave the best results. The stock solution is prepared by heating 1 lb. commercial soda in 1 gal. water. When this boils, 1 lb. resin is added and the whole allowed to boil vigorously. One more gallon of water is then added at intervals. If milkiness results when a little cold water is added to a sample of the mixture, boiling should be continued. It is used at a dilution of 1 : 6, two treatments during July and August being sufficient to hold the pest in check. Other control measures recommended are a light application of nitrogenous manure at the flowering stage (late August or early September) ; delaying the sowing of the crop until late May or early June in order to escape the period of maximum infestation ; and breeding varieties resistant to attacks by *Bemisia*.

An editorial note states that the views here put forward as to the reasons for the periodic failures of American cotton in the Punjab are not generally accepted by cotton research workers in India.

EDWARDS (W. H.). **Report of the Government Entomologist.**—*Ann. Rep. Dept. Agric. Jamaica 1931*, pp. 22–24. Kingston, 1932.

Insect pests observed in Jamaica during 1931 include *Pieris* (*Pontia*) *monuste*, L. (which breeds in large numbers on the cruciferous weed, *Cleome ciliata*) on cabbage ; *Gryllus assimils*, F., causing serious injury to strawberries and many other garden plants ; *Pseudococcus brevipes*, Ckll., on pineapples growing on poor, clay soil ; the Noctuid, *Lyncestis acontioides*, Guen., *Oncideres amputator*, F., and *Apate terebrans*, Pall., attacking shade and ornamental trees, *Apate* being controlled by placing crystals of paradichlorobenzene in the galleries, the entrances to which are then blocked with clay, and the periodical damage caused by *Lyncestis* being minimised by the application of grease bands to the

trees; and *Aleurodicus pimentae*, Lg. [*R.A.E.*, A, xix, 402] and a Tingid, *Leptostyla* sp., on pimento, the latter being found to be the cause of spots on the leaves known as "thrip rust."

Severe outbreaks of *Prepodes vittatus*, L., and less important ones of *Pachnaeus litus*, Germ., occurred in *Citrus* groves. Hand-collecting the adults and burying a crude form of paradichlorobenzene in the soil around the base of the plants as a deterrent proved very effective. *Coccus viridis*, Green (green scale), in association with the ants, *Cremastogaster brevispinosa* var. *minutior*, For., and *Solenopsis geminata*, F., severely attacked young *Citrus* plants and older trees on poor soil. This scale insect also causes considerable damage to coffee at high altitudes, where it is grown in exposed situations without shade trees. At low altitudes where the crop is cultivated under reverse conditions, the scale is very effectively controlled by fungi. Experiments showed that fumigation of the bushes under covers with hydrocyanic acid gas is the cheapest and most effective measure. A mixture of resin dissolved in equal parts of boiling castor oil and raw linseed oil, applied to the stems on bands of cellophane, was sufficiently cheap and effective for use on a large scale against the ants that foster its spread.

Silvanus surinamensis, L., *Necrobia rufipes*, DeG., and *Ephestia cautella*, Wlk., caused serious damage to copra, which was also attacked by *Tribolium castaneum*, Hbst., *Cathartus advena*, Waltl, and *Carpophilus dimidiatus*, F. It appears that low grade copra is more attractive to these beetles than well cured material from dry nuts. Defective storage conditions in rural warehouses and factories are the main causes of infestation. Whenever practicable, infestations were controlled by fumigation with hydrocyanic acid gas. Laboratory experiments showed that copra that has become mouldy is more attractive to *Ephestia* than that of better quality. A survey of factories, warehouses, etc., showed that cacao beans are rarely infested by insect pests in Jamaica, chiefly owing to the rapidity with which they are handled and exported, though in a few instances *E. elutella*, Hb., was found in them.

CHORLEY (J. K.). **Report of the Chief Entomologist for the Year ended 31st December 1931. Agricultural.**—*Rhodesia Agric. J.*, xxix, no. 7, pp. 522–524. Salisbury, July 1932.

No serious outbreaks of insect pests occurred on agricultural crops in Southern Rhodesia during 1931. A few small outbreaks of *Laphygma exempta*, Wlk. (army worm) were reported from several districts. The application of derrisol gave a mortality of 91 per cent. of young larvae of *Busseola* (*Glottula*) *fusca*, Fuller, in a trap crop of small maize plants, and further tests showed an average infestation of 16 per cent. on the treated plants and 97 per cent. on the untreated. Other insects prominent on maize included *Apophyllia murina*, Gerst., *Systates exaptus*, Mshl., and *Margarodes*. *Phthorimaea heliopa*, Lw., caused considerable damage to tobacco in certain localities. *Citrus* was severely attacked by *Scirtothrips aurantii*, Faure, but control was obtained by spraying with lime-sulphur. Owing to favourable conditions during the rainy season, *Chrysomphalus* (*Aonidiella*) *aurantii*, Mask., increased rapidly when efficient control was not carried out. *Argyroploce leucotreta*, Meyr. (false codling moth) appears to be increasing, but is not yet of economic importance. It is parasitised by *Glypta leucotretae*, Wlkn. [*R.A.E.*, A, xix, 712]. Cotton was damaged

by *Earias* sp., *Diparopsis castanea*, Hmps., and *Dysdercus* spp. *Calandra oryzae*, L. (maize weevil) was found attacking apples in two orchards. *Phytomeira orichalcea*, F., was reported destroying various crops, chiefly sunflower, in several centres. The infestation came to an end in February largely owing to the depredations of parasites and disease. Insects observed for the first time in Southern Rhodesia were a weevil, believed to be *Cylas compressus*, Hartm., on sweet potatoes, *Pseudococcus nipae*, Mask., on palms, and *Ceronema africana*, Macfie, on cultivated fig.

Brooks (A. J.). **Virus Diseases of Groundnuts.**—*Ann. Rep. Dept. Agric. Gambia 1931–32*, pp. 9–11. Bathurst, 1932.

Aphis laburni, Kalt. (*leguminosae*, Theo.), the vector of rosette disease of ground-nuts [*Arachis hypogaea*] in South Africa [*cf. R.A.E.*, A, xv, 569, etc.], was found for the first time in Gambia during March 1932 on self-sown ground-nuts [*cf.* xvii, 49].

Davidson (J.). **On the Viability of the Eggs of *Sminthurus viridis* L. (Collembola) in Relation to their Environment.**—*Aust. J. Exp. Biol. Med. Sci.*, x, pt. 2, pp. 66–88, 10 figs., 5 refs. Adelaide, 16th June 1932.

This further account of experiments on *Smynthurus viridis*, L., in South Australia [*cf. R.A.E.*, A, xx, 432] deals with the influence of dry conditions on the viability of its eggs.

The following is taken from the author's summary: *S. viridis* is present in large numbers in certain areas of the State during the wet season (May–October) and normally does not occur during the dry one, when certain eggs remain viable in the soil. The dormant condition is not a definite rhythmical diapause, but one enforced by dry conditions, which arrest the development of the egg. Development of the eggs is retarded when the soil moisture is maintained below about 10 per cent., and they fail to hatch when it is kept below about 5 per cent. When batches are removed from moist soil within a day or two of being laid and allowed to dry, many eggs are killed. The mortality is not so great if the batches are left undisturbed on the soil and the latter allowed to dry out. The number of eggs that survive the dry conditions depends chiefly on their stage of development when the dry conditions set in, and the severity and duration of the conditions, especially with reference to the temperature and relative humidity of the air. Eggs that have attained a stage of development represented by about 4 days' incubation at 25°C. [77°F.] are more resistant to temporary dry conditions. This resistance is related to the changes that occur during the development of the embryo. Certain eggs in a batch exhibit delayed hatching. This appears to be due to the position of the eggs in the batch and the size and formation of the latter, and to the individuality of particular eggs, probably in regard to the thickness and permeability of the chorion.

Hardy (G. H.). **Aphididae in Australia.**—*Proc. R. Soc. Queensland*, xliii, pp. 31–36. Brisbane, 23rd March 1932.

An account is given of the Aphids occurring in Australia, only one of which, *Anomalaphis comperei*, Baker, is considered to be definitely indigenous, with lists of some of the species collected from over 80

plant genera and their food-plants and of 29 genera of indigenous plants that harbour Aphids.

The subtribe Pentalonina is dealt with in detail, a key to the genera being given. *Pentalonia caladii*, v. d. Goot, is considered a synonym of *P. nigronervosa*, Coq., the vector of bunchy top of bananas. Other food-plants of this species include *Musa* spp., *Strelitzia*, *Ravenala*, *Caladium*, *Alocasia macrorrhiza*, *Opuntia inermis*, *Hedychium coronarium*, *Alpinia vittata variegata*, *Heliconia* and *Dieffenbachia magnifica*.

CORBETT (G. H.). **Entomological Notes. Second Quarter, 1932.**—*Malayan Agric. J.*, xx, no. 7, pp. 370–372, 1 pl. Kuala Lumpur, July 1932.

Artona catoxantha, Hmps. (coconut Zygaenid) appeared in numbers over some 60 acres of tall coconut palms in early April. Its occurrence at this time of the year is unusual, the prevalence of high winds and heavy rains being generally considered responsible for its absence. A mixture of 16 lb. resin dissolved in 1 gal. castor oil, painted on the trunks in rings of about 2 ins. wide, prevented those caterpillars that had been blown to the ground from re-ascending the trees. This remains effective for at least 2 weeks and may be revived by being rubbed with a coconut husk that has been steeped in castor oil.

CURTLER (E. A.). **The Cultivation and Manufacture of Tea in Ceylon and India.**—*Gen. Ser. Dept. Agric. S.S. & F.M.S.*, no. 9, 94 pp., 5 pls. Kuala Lumpur, 1932.

Brief notes (pp. 53–56) on the commoner pests of tea in Ceylon and Assam and methods for their control are included in this bulletin, which contains detailed information on the various operations involved in the production of tea in these countries. The presence of Aphids on the leaves of tea is considered to improve the flavour of the manufactured article, a higher price being obtained on one estate in years of heavy infestation.

COTTIER (W.). **Insecticidal Treatment of the Grass-grub (*Odontria zealandica* White).**—*N. Z. J. Sci. Tech.*, xiii, no. 6, pp. 317–340, 2 figs., 9 refs. Wellington, N.Z., June 1932.

An account is given of experiments in New Zealand against *Odontria zealandica*, White (grass grub) in small areas. The best results were obtained with acid lead arsenate, carbon bisulphide, and a commerical product (Restar), the active principles of which are certain tar-acids and hydrocarbons. Acid lead arsenate gives control for two or more years, whereas the others only remain effective for the current season. When infestation is so severe that it is necessary to remake a lawn, the lead arsenate is applied as a powder, after a fine seed-bed has been prepared, at the rate of 2 lb. to 100 sq. ft., and worked in so that when the ground is consolidated the poison will extend to a depth of approximately 2 ins. It may also be watered into existing turf at the rate of 3 lb. to 100 sq. ft. or used in a top dressing or for poisoning turf which is to replace that already damaged by the grub. Carbon bisulphide may be applied alone, in holes 3–4 ins. deep and 1 ft. apart at the rate of 15 c.c. to each hole, the holes being plugged as soon as the liquid has been introduced, or as an emulsion in mixture with Restar at the rate of

3½ gals. to the square yard. No injury is caused to the grass by the latter if it is carefully applied; the formula is 250 c.c. carbon bisulphide, 250 c.c. water and 36 c.c. Restar, diluted with 135 parts water. Restar may be used at the rate of 1 part to 150 parts of water, using 3 gals. of this to the square yard followed immediately by 3 gals. of water, but is recommended for turf only as a substitute for carbon bisulphide.

The use of naphthalene, which was the best of the remaining materials tested, is limited to loose fallow soil preparatory to planting and for potting work. It should be applied at the rate of 3–4 oz. to the square yard and worked in to a depth of 3 inches. Tests with mercury bichloride in economical quantities showed it to be useless as a remedy against *O. zealandica*.

Bovien (P.). **Om Porremøllet** (*Acrolepia assectella* **Zell.**) **og dets Biologi.** [The Leek Moth, *A. assectella*, and its Biology.]—*Tidsskr. Planteavl*, xxxviii, pp. 334–344, 7 figs, 4 refs. Copenhagen, 1932. (With a Summary in English.)

A brief account is given of the biology of *Acrolepia assectella*, Zell., as the result of laboratory and field observations made in 1930 in Denmark, where this moth has been known for some years as a serious pest of leeks. Hibernation takes place in the adult stage. Oviposition occurs on the leaves from mid-May to late June, and the larvae hatch in 5–8 days and mine in the leaves for a short period, after which they attack the growing point. Moths of the first generation appear from early July, their oviposition period being long and undefined. The larvae of the second generation, which cause the most serious damage, pupate in September and October, and adults appear late in the autumn. Individual moths of the second generation were seen to oviposit in the laboratory, indicating the possibility of a third generation.

Control measures are discussed, the best results being obtained with a 0·2 per cent. solution of nicotine. Cutting down the plants to within about 1 inch of the ground is recommended only in the case of very severe attacks. A Dipterous larva found mining and pupating in onion leaves, and causing injury very similar to that done by *A. assectella*, was determined as a species of *Hydrellia*, possibly *H. griseola*, Fall.

Feytaud (J.). **Les ennemis du tabac.**—*Rev. Zool. agric.*, xxxi, nos. 1–2, pp. 1–9, 22–26, 1 pl., 4 figs., 1 ref. Bordeaux, January-February 1932. [Recd. July 1932.]

A popular account, mainly taken from the literature, is given of insects attacking tobacco in various parts of the world, with details in each case of control measures advocated both in Europe and North America, whence most of the pests of tobacco have originated.

Bruneteau (J.). **A propos des invasions de Sphinx. Le** *Deilephila lineata* **var.** *livornica* **Esp.**—*Rev. Zool. agric.*, xxxi, no. 1, pp. 9–15, 22 refs. Bordeaux, January 1932. [Recd. July 1932.]

An account is given of infestations of *Celerio* (*Deilephila*) *lineata* var. *livornica*, Esp., that occurred in the region of Bordeaux in June 1931 [*cf. R.A.E.*, A, xx, 240], including a history of previous sporadic appearances of this Sphingid in several parts of the world. It appeared before 15th June at four points in south-western France several hundred

miles apart. The infestations were brief, and reproduction was checked by parasitism and attacks of birds. The only recorded parasites of this moth, which occur in Algiers, are an unidentified Hymenopteron and a Tachinid, *Erycia girovaga*, Rond. Control measures suggested include hand collection of the larvae and the use of light and bait traps. Bordeaux mixture applied in sufficient quantities was found to exercise a repellent influence on the larvae, and spraying with this material or with nicotine is advised. Lead arsenate would probably be effective in the case of serious infestation, but its use in France is prohibited on vines after the flowering period and also on buckwheat, these being the two plants mainly subject to attack.

CHEVALIER (A.). **Nouvelles observations sur les sauterelles du Sahara, du Niger et du Soudan français.**—*Rev. Bot. appl. Agric. trop.*, xii, nos. 131–132, pp. 509–517, 622–628, 1 fig., 10 refs. Paris, July–August 1932.

An account is given of observations on locusts, made during a journey across the Sahara to the Niger and the French Sudan from December to April 1931, with notes on the seasonal migrations of each species, of which *Locusta migratoria migratorioides*, Rch. & Frm., and *Schistocerca gregaria*, Forsk., are the most important.

Although inhabiting two different geographical areas, these two species occur together in a narrow intermediate zone for a fairly long period during the summer rains, when green vegetation is present and breeding takes place. The rains begin near the tropical forest in February or March and gradually move towards the north, reaching the southern Sahara in July or August. The northern limits of the Sahara are reached by rains in winter, and the seasonal migrations of *Schistocerca* coincide with the changes of the rain belt. When the vegetation in the southern Sahara becomes dried up after the rainy season, swarms of *Locusta* migrate southwards into the hilly areas adjoining the forest zone, where there is green vegetation and winter breeding takes place. Both species are thus remarkably well adapted to the seasonal cycle of weather in their respective zones of reproduction.

It is considered that the migrations of *Schistocerca* across the Sahara originated during an earlier geological epoch, when the area now occupied by desert was well watered, so that locust swarms were able to migrate along river valleys, and that this habit of seasonal migration still persists, although it necessitates crossing about 1,200 miles of desert.

The climate of the French Sudan also appears to have been modified, but more recently than that of the Sahara, and *L. m. migratorioides* appears to be imperfectly adapted to the new conditions. Rainy seasons are now shorter and less regular owing to deforestation and the burning of grass. Savannah grasses are often dried up and burnt by October, so that there is no food for the locusts, which concentrate on the cultivated fields of *Sorghum* and rice, inflicting great damage. As deforestation proceeds, the locusts penetrate further south.

Anacridium moestum melanorhodon, Wlk. (tree locust), which is of less importance than the other two species, occasionally causes some damage to *Citrus* and other fruit trees, as well as to *Butyrospermum parkii*. Its swarming flights mainly occur at night.

COMMUN (R.). **Un parasite des mạ en Indochine,** *Spodoptera mauritia* **Boisd. (Noctuidae).**—*Bull. écon. Indochine,* xxxv, pp. 154B–159B, 18 refs. Hanoi, 1932.

Spodoptera mauritia, Boisd., all stages of which are briefly described, caused serious injury to young rice in nurseries in several districts in Indo-China during 1931–32. Much of the information on its life-history and control is similar to that already noticed [*R.A.E.*, A, v, 500; ix, 10, etc.]. Notes are given on its food-plants and geographical distribution. The eggs are laid in batches of 200–400 on the lower surface of the leaves of rice or other graminaceous plants in or near rice fields and hatch in about 7 days. When fully grown, the larvae burrow into the ground to a depth of a few centimetres, where they construct a cell in which to pupate, the adults emerging 10–12 days after pupation. Adults reared in the laboratory lived on an average 2 days.

FRAPPA (C.). **La mouche des fruits à Madagascar,** *Drosophila repleta* **Woll.**—*Bull. Acad. malgache,* N. S. xiii (1930), pp. 117–124, 25 refs. Antananarivo, 1931. [Recd. August 1932.]

Drosophila repleta, Woll., which for a number of years has been observed on peaches, plums, mangos, oranges and lemons on the high tablelands of Madagascar, caused such extensive injury in 1928 that 75 per cent. of the oranges sold in the market at Antananarivo were found to be infested. As the author has never seen any trace of *Ceratitis capitata,* Wied., during 3 years' investigations in Madagascar, it appears possible that the larvae formerly identified on peach as this species [*R.A.E.*, A, iii, 276; viii, 133] were in reality those of *D. repleta,* which seems to be distributed throughout the Island. All stages of this Drosophilid are described. The adults appear about mid-November and may thereafter be found until the end of the following July, being particularly abundant at the fruiting periods of the various fruit trees. The eggs are laid on the skin of fruit that is almost or entirely ripe, and may be found in groups of 5–6 embedded in the skin of oranges to a depth of 2–3 mm. The larvae hatch in a few days and mine towards the centre of the fruit, where they feed for 10–12 days, leaving the fruit to pupate. The pupal stage lasts 6–7 days, and the life-cycle 22–28. Some adults reared in the laboratory lived more than 15 days, whereas others died in 4–8 days.

In order to determine the stage in which *D. repleta* passes the period from May to December, which does not appear particularly favourable to its development, experimental rearing was carried out on alcoholic or acetic solutions, such as would be found in open wine bottles, etc. It was found that it was capable of developing under these conditions without interruption from April 1929 to March 1930. The strong attraction for this fly exercised by various fermenting substances would indicate that in addition to the normal development on various little-known, wild native fruits, it would also be possible for it to continue its existence on manure heaps and decomposing vegetable refuse, Experiments to determine the tropisms exercised by the various fruits upon this insect, combined with the experience of other workers, indicate that the attraction of *D. repleta* is not due to the presence of the essential oils, but rather to the slow generation of more or less complex gases produced by the action of the acids present in the fruits on alcohol formed following fermentation.

Infested fruit appears to mature normally on the trees, but falls to the ground before it is quite ripe. On examining oranges the day they fall, a small spot of yellowish-black discolouration may be observed. This spot rapidly becomes enlarged, and if the fruit is cut open, several almost fully developed larvae will be found and the greater part of the fruit will already be rotten. With experience it is possible to detect infested fruit even on the trees by feeling the surface for a soft spot, although nothing is visible on the exterior. On peaches, plums and apricots the injury caused is rather less severe, the estimate for 1928 varying between 15 and 40 per cent., as compared with 75–80 per cent. on oranges.

Control measures instituted after the severe damage suffered in 1928 included the daily collection of fallen fruit, which was afterwards buried, preferably in quicklime, and weekly ploughing of the soil beneath fruit trees to destroy the pupae or hinder their development. These measures alone reduced the percentage of infested oranges to 35 per cent. in 1929. An attempt was also made to kill the adults by means of bait traps, the bait consisting of ten oranges crushed with $\frac{1}{4}$ lb. cheap sugar, 2 oz. sodium arsenite and $\frac{1}{4}$ pint water, to which, after it has been brought to the consistency of a jelly and cooled, about $\frac{1}{2}$ gill of vinegar is added. When this bait was placed in a small receptacle in a cage containing 52 flies, 37 were found dead at the end of 3 hours and the remainder died before the following day. Though the efficiency of the bait under field conditions is difficult to determine, its use is recommended in orchards just before the fruit ripens, when it should destroy some of the flies of the hibernating generation and prevent them from ovipositing.

Trouvelot (B.). **Recherches sur les parasites et predateurs attaquant le doryphore en Amérique du Nord et envoi en France des premières colonies des espèces les plus actives.**—*Ann. Epiphyties*, xvii (1931), no. 6, pp. 408–445, 5 figs., 49 refs., Paris, June 1932.

A detailed account, based partly on the literature and partly on the author's observations, is given of the insect enemies of *Leptinotarsa decemlineata*, Say (Colorado potato beetle) in North America. The history and importance of the various known parasites and predators of this beetle are discussed, and descriptions of the principal species are quoted, notes on the distribution and life-history being appended in each case. The more important of the secondary parasites are briefly reviewed. The part played by insect enemies in the natural control *L. decemlineata* in North America is discussed, the reduction effected by their combined attacks averaging between 10 and 20 per cent. It has, however, been observed that in small isolated foci of the beetle, predators such as *Perillus bioculatus*, F., sometimes multiply so rapidly that the infestation is practically exterminated. In other cases where the Tachinid, *Doryphorophaga*, has been abundant in infested fields in June, *L. decemlineata* has subsequently been present only in sensibly reduced numbers. The most active species do not appear to operate in the same regions, so that their favourable influence is well distributed, *Doryphorophaga doryphorae*, Riley, being common in the north and *D. aberrans*, Towns., in the south. *Lebia grandis*, Hentz, is primarily abundant in sandy soils, whereas *P. bioculatus* chiefly occurs under conditions most favourable to *L. decemlineata*, where the winters are mild and where there is abundance of shelter for hibernation.

Attack by these enemies in a new area of infestation is generally slight at the outset, but increases progressively from year to year.

The most active of the insect enemies of *L. decemlineata* seem to have the same habitat as their host, originating in the high tablelands bordering the eastern extremity of the Rocky Mountains. Attempts to discover additional parasites likely to attack this beetle among other species of *Leptinotarsa* occupying adjacent regions have hitherto proved unsuccessful. If such parasites exist, the fact that they have not naturally followed the advance of *L. decemlineata* probably indicates that their biological requirements do not admit of their development at lower altitudes or in a damper climate than obtain in Colorado.

In view of the fact that eight years after the establishment of *L. decemlineata* in France no native parasite or predator has developed any degree of control over the beetle comparable to that exercised by *D. aberrans*, *D. doryphorae*, *P. bioculatus* or *L. grandis*, it appeared highly desirable to introduce these insects from the United States [*cf. R.A.E.*, A, xix, 85, 585], and a comparative study of the respective climates has indicated no obstacle to the success of such an attempt. The first shipments made in 1928 showed that they can survive a sea voyage of 10 days. The technique of their transport, which is described, although still imperfect, afforded satisfactory results in the introduction of the early colonies, but the mortality in course of transit remained very high, and future consignments should be on a large enough scale to afford attempted establishment a maximum chance of success. The technique developed for breeding in captivity has proved adequate in the case of the first three species, but sufficient knowledge of its biology does not at present allow of developing similar rearing methods for *L. grandis*. The introduction of these American parasites into France having proved practicable, their release on a large scale is now merely a question of perseverance and funds.

ZACHER (F.). **Interessante Fälle des Schädlingsauftretens an Nahrungs- und Genussmitteln, Webwaren und Baustoffen.** [Interesting Cases of the Occurrence of Pests in Foodstuffs, Fabrics and constructive Timber.]—*Mitt. Ges. Vorratsschutz*, viii, no. 4, pp. 42–48. Berlin, July 1932.

Pests of stored products observed in Germany in recent years include : the Tenebrionid, *Alphitophagus bifasciatus*, Say, which had not previously been recorded and was found in two localities in 1930 attacking grain ; *Dermestes lardarius*, L., in chocolate containing puffed rice and ground-nuts ; the Indian meal-moth, *Plodia interpunctella*, Hb., in seeds of forget-me-not, asparagus and lettuce ; *Latheticus oryzae*, Waterh., and *Lophocateres pusillus*, Klug, in macaroni ; *Necrobia rufipes*, DeG., in dried egg yolk ; *Anobium punctatum*, DeG. (*striatum*, Ol.), boring holes in linen tablecloths ; the Cerambycid, *Gracilia minuta*, F., which severely infested willow wicker covers of glass flasks ; and *Hylotrupes bajulus*, L., which has become a serious pest in buildings in many districts [*cf. R.A.E.*, A, xix, 379]. The Tenebrionid, *Blaps mucronata*, Latr., occurred in numbers in a stable in Berlin, in association with a few *B. lethifera*, Marsh., and the death of one of the horses in it was believed to be due to swallowing this beetle. Large numbers of mites, *Phaullocylliba marginatus*, and the Collembolan, *Tomocerus minor*, Lubb., infested wooden shavings in a vinegar factory and entered the vinegar.

In tests against the clothes moth [*Tineola biselliella*, Humm.], an exposure of at least 40 days to a temperature of —4·7°C. [23·6°F.] was found necessary to kill all the larvae.

SCHNEIDER (H.). **Ueber den Frassschaden des Kornkäfers** (*Calandra granaria* **L.**). [On the Damage caused by the Feeding of the Grain Beetle.]—*Mitt. Ges. Vorratsschutz*, viii, no. 4, pp. 49–52, 2 graphs. Berlin, July 1932.

In order to determine the extent of the damage caused to wheat and barley by *Calandra granaria*, L., and *Silvanus* (*Oryzaephilus*) *surinamensis*, L., experiments were carried out over a period of 27 weeks ending 8th March 1932. Beetles and grain were placed together in glass bowls and kept in darkness at room temperature, the edges of the bowls being treated with an adhesive to prevent the insects from escaping. A comparison of the weight of the infested grain with that of the control showed a loss of 32·3 per cent. in the bowl in which 250 gm. of winter wheat had been placed with 1,000 individuals of *Calandra*, and one of 12·3 per cent. in that with 250 weevils ; losses of 10·3 and 6·3 per cent. were obtained with 400 and 100 weevils respectively in bowls that originally contained 100 gm. of winter barley. In the case of *S. surinamensis*, the loss in the weight of wheat was 4·2 per cent. at the rate of infestation of 4 beetles to 1 gm. of grain. It was found that the numbers of *Calandra* in the bowls of wheat had increased to 1,578 and 494 respectively during the 27 weeks, whereas in those of barley they had decreased to 8 and 5. Of *Silvanus* only one individual survived.

In granaries, repeated turning over of the infested grain with a spade causes the adults of *C. granaria* to abandon the grain and congregate in dark corners, where they can be swept in heaps and destroyed.

In experiments with poison dusts for the protection of grain intended for seed [*cf. R.A.E.*, A, xvii, 641], 0·4 gm. magnesium oxide or magnesium hydroxide was thoroughly mixed in a glass bowl with 100 gm. of wheat and about 200 adults of *C. granaria* or with the weevils alone, and kept for 7 days at temperatures varying from 16 to 20°C. [60·8 to 68°F.] and a relative atmospheric humidity of 54 per cent. All the weevils were killed in the bowl with magnesium hydroxide only, and 95 per cent. in that with grain as well ; in the case of magnesium oxide, the figures were 87 and 58.

HASE (A.). **Ueber die Dauerwirkung des Mottenschutzes durch Eulan. I. Teil. Ueber 10 Jahre lang bestehende Mottenechtheit von Wolle durch Imprägnierung mit "Eulan F."** [On the lasting Effect of Eulan against Moth Infestation. Part i. On the Retention for ten Years of the mothproof Quality of Wool impregnated with "Eulan F."]—*Anz. Schädlingsk.*, viii, no. 7, pp. 73–82, 5 figs., 11 refs. Berlin, 15th July 1932.

In tests in Berlin during 1931–32, a detailed account of which is given, small pieces of wool fabric that had been impregnated with "Eulan F" in 1921 [*R.A.E.*, A, ix, 611] were exposed to attack by larvae of various instars of the clothes moth, *Tineola biselliella*, Humm., in a dark breeding chamber at a temperature of 25°C. [77°F.]. In all cases the larvae failed to feed and died from starvation either before or after spinning cocoons, which they made from the nap, without, however, eating through the fabric.

Houben (I.). **Ueber insektentötende Pflanzenstoffe. I. Die Derris-Giftstoffe. A. Geschichtliches und Literatur.** [On insecticidal Plant Products. i. Derris poisonous Materials. A. History and Literature.]—*Anz. Schädlingsk.*, viii, no. 7, pp. 83–88, numerous refs. Berlin, 15th July 1932.

This is a brief review of the literature dealing with the preparation and use of rotenone and allied constituents of *Derris* and other fish-poison plants in the control of insects.

Bakó [G.]. **Zu dem Auftreten der San-José-Schildlaus in Ungarn und Oesterreich.** [On the Occurrence of the San José Scale in Hungary and Austria.]—*NachrBl. deuts. PflSchDienst*, xii, no. 8, pp. 63–64. Berlin, August 1932.

In view of the occurrence of the San José scale [*Aspidiotus perniciosus*, Comst.] in Hungary and its introduction into Austria in 1931 [*R.A.E.*, A, xx, 506], an account is given of the regulations respecting it that were passed in Hungary in February 1932.

Lederer (G.). **Einführung in die Schädlingskunde.** [Introduction to a Knowledge of Pests.]—8vo, xvi+472 pp., 33 pls., 248 figs. Guben, Verlag int. ent. Z., 1928–1932.

Various chapters of this text-book on the control of parasites and pests of man, animals, plants, and stored products deal with:—the importance of insects; the damage done to plants; factors influencing insect abundance; epidemiology; cultural, biological, chemical and physical control methods; the more important pests; and the German plant protection service. A bibliography and a subject index are included.

Candura (G. S.). **Contributo alla conoscenza biologica del *Troctes divinatorius* Müller.** [A Contribution to the Knowledge of the Biology of *Liposcelis divinatorius*.]—*Boll. Zool.*, iii, no. 4, pp. 177–184, 1 fig., 2 refs. Naples, August 1932.

These observations on the Psocid, *Liposcelis* (*Troctes*) *divinatorius*, Müll., were made in South Italy during recent years. The adults occur throughout the year in stores of animal or vegetable products, in dwellings and animal quarters. Any organic material stored for long is subject to attack, the severest infestations occurring in dark, damp rooms. Reproduction was always parthenogenetic [*R.A.E.*, A, xviii, 417]. The average number of eggs per female is 50–60 in summer and 20 in winter. The total life-cycle requires from 21 days in summer to 140 days in winter, the egg-stage lasting from 4 days to 4 weeks and the adult stage from 1 week to 3 months. All stages occur in winter. Normally, there are 6–8 generations a year. The larvae and adults of *Tenebroides mauritanicus*, L., prey on *L. divinatorius* if confined very closely with it, but not otherwise. The exposure of infested objects to sunshine and air will free them from slight infestations. Severe ones may be dealt with by shutting up the rooms and heating them to

50–60°C. [122–140°F.] or by burning sulphur at the rate of 25–30 oz. per 1,000 cu. ft. Fumigation with carbon bisulphide and immersion in boiling water are other remedies.

Boselli (F. B.). **Studio biologico degli emitteri che attaccano le nocciuole in Sicilia.** [A biological Study of the Rhynchota attacking Hazel-nuts in Sicily.]—*Boll. Lab. Zool. Portici*, xxvi, pp. 142–309, 52 figs., 2 pls., 10 refs. Portici, 22nd June 1932.

A biological study of the bugs infesting hazel nuts [*Corylus avellana*] in Sicily was begun in 1930 owing to the serious losses caused to this crop and the import restrictions imposed upon it in the United States.

The species dealt with are the Coreid, *Gonocerus acuteangulatus*, Goeze, the Pentatomids, *Palomena prasina*, L., *Piezodorus lituratus*, F. *Carpocoris pudicus* var. *fuscispina*, F., and *Dolycoris baccarum*, L., and the Lygaeid, *Spilostethus* (*Lygaeus*) *pandurus*, Scop. All stages of these bugs, except *S. pandurus* and the nymph of *D. baccarum*, are described. The last four species do not normally oviposit on hazel, and attack the nuts in the adult stage only, more or less accidentally. Another Pentatomid, *Rhaphigaster nebulosa*, Poda, oviposits on hazel, but is of no economic importance.

G. acuteangulatus, the most injurious species, hibernates in the adult stage (usually in dense grass such as *Ampelodesmos tenax*, or in ivy) from September to mid-May ; at day-temperatures above 20°C. [68°F.], it was observed on hazel, especially bushes with precocious nuts. Adult feeding is confined to the nuts and results in the latter becoming stained and rotten. From June to August, hazel appears to be the sole food-plant, at least in the districts where it is largely grown. The eggs are laid in June, usually on the bracts enclosing the nuts, and hatch in 12–15 days. A female fertilised early in June continues ovipositing until early August. There appears to be only one generation a year. The injury caused to the nuts by the immature stages is not comparable with that by the adults. In September this Coreid leaves hazel and is then mostly found on chestnut up to the time of hibernation. About 15 per cent. of eggs collected in August 1931 were found to be parasitised by a Eupelmid, *Anastatus* sp., possibly *A. bifasciatus*, Boy., and 28–30 per cent. by a Scelionid, *Telenomus* sp., another Scelionid, *Microphanurus* sp., being very rare. Descriptions are given of these parasites.

P. prasina is very injurious to hazel under dry cultivation but seems unimportant in irrigated areas. It has one generation a year, hibernation taking place in the adult stage on bushes, such as *Cistus*, from October to April. In April and May the bugs are found on trees in blossom or on cultivated herbaceous plants. Oviposition occurs almost exclusively on hazel, from mid-May to the end of June, over 100 eggs being laid per female. The hibernated adults do not feed on hazel. The egg stage occupies about 10 days and the nymphal ones 50–55. Injury is done in July by nymphs of the last stage. The adults of the new generation appear about mid-July and feed on the nuts up to mid-August, when they migrate to chestnut, blackberry, etc., remaining on these until the end of September. A Capsid, *Deraeocoris flavilinea*, Costa, destroyed 10–15 per cent. of the eggs in 1930. A Scelionid, *Telenomus* sp., was usually found to parasitise 35–40 per cent. of the eggs, a maximum of 60 per cent. being observed, and the ant, *Cremastogaster scutellaris*, Ol., feeds on the eggs, but is of little importance.

Şevket (N.). **Örümce.** [The Bionomics and Control of *Hemerophila* (*Simaëthis*) *pariana* L. in Turkey. (*In Turkish.*)]—*Ziraat gaz.* [*Agric. Gaz.*], 1932, no. 8, reprint 14 pp., 5 figs. Ankara, 1932.

This paper is a semi-popular account of the bionomics and control in Turkey of *Hemerophila* (*Simaëthis*) *pariana*, Cl., where it is a pest of figs of some importance.

van Poeteren (N.). **Verslag over de Werkzaamheden van den Plantenziektenkundigen Dienst in het jaar 1931.** [Report on the Work of the Phytopathological Service in 1931.]—*Versl. Plantenziektenk. Dienst*, no. 66, 134 pp., 5 pls. Wageningen, August 1932.

Many of the pests in Holland recorded here have been noticed in previous reports [*R.A.E.*, A, xvii, 427, 635; xix, 242, 739, etc.]. Others include: a leaf-roller on peas, *Cnephasia pasivana*, Hb., which is possibly a form of *C. wahlbominana*, L., neither, however, having previously been recorded from peas; *Spilosoma lubricipeda*, L., which attacked the leaves of grape-vines in greenhouses; the Carabid, *Ophonus pubescens*, Müll., which attacked the seed of strawberries and was trapped in pots sunk to the level of the soil and half filled with water with a trace of kerosene; the asparagus fly, *Platyparea poecilloptera*, Schr., which was reported for the first time in Holland; the Tortricid, *Peronea* (*Acalla*) *schalleriana*, L., which rolled the leaves of roses in greenhouses, the removal of infested buds being the measure advised; *Eurytoma orchidearum*, Westw., which mined the bulbs of orchids (*Cattleya*) and which had not been reported since 1914; the Cerambycid, *Hylotrupes bajulus*, L., which seriously attacked a wooden house; and the weevil, *Brachyderes incanus*, L., which migrated from pines to a neighbouring orchard, where it infested the leaves of plums and the twigs of cherries, apples and pears being left untouched. *Plodia interpunctella*, Hb., severely attacked a cargo of ground-nuts from China, and *Tineola biselliella*, Humm., and *Borkhausenia pseudospretella*, Staint., infested bales of human hair stored at Rotterdam. An infestation of bottle corks by *Tinea cloacella*, Haw., was checked by putting capsules on them. About 12,000 wicker baskets had to be burned owing to infestation by the Cerambycid, *Gracilia minuta*, F.

Spraying with Paris green or nicotine has given good results against the cabbage beetle, *Meligethes aeneus*, L. *Aphelinus mali*, Hald., was distributed in many districts against the woolly apple aphis [*Eriosoma lanigerum*, Hausm.]. A spray of 1 per mille nicotine (95–98 per cent.) has been found effective against the raspberry beetle, *Byturus tomentosus*, F., and one of 2 per mille proved excellent against *Phytomyza chrysanthemi*, Kowartz, on *Chrysanthemum* if it was carefully and thoroughly applied.

Ultée (A. J.). **Verslag over de werkzaamheden van het Proefstation Malang in het jaar 1931.** [Report of the Malang (Java) Experiment Station for 1931.]—*Meded. Proefst. Malang*, no. 82, 55 pp. Surabaya [1932].

The following is taken from the report of the entomologist, Dr. J. G. Betrem (pp. 17–26), which deals chiefly with the coffee twig-borers.

Serious injury observed in the dry season was found to be due to the spread of the black twig borer [*Xyleborus morstatti*, Hag.] coupled with an almost entire lack of its natural enemies and the unfavourable condition of the coffee plants after two dry years. *Cassia tora*, *C. hirta* and *Sambucus* were observed to harbour twig-borers, and in one plantation the last was infested almost exclusively by the brown twig-borer [*X. morigerus*, Bldf.]. The species previously recorded from coffee in Java as *X. discolor*, Bldf. [*R.A.E.*, A, xx, 86] appears to be a species of *Dryocoetes*. Both *X. morstatti* and *X. morigerus* seem to need maturation feeding on ambrosia fungus before ovipositing, and it is confirmed that this fungus cannot grow unless there is a sufficiency of moisture in the plant [xix, 568]. The direct injury by the borers is slight, but the ambrosia and other fungi associated with them are very harmful. It was found that when *X. morstatti* began to appear it was readily parasitised by a species of *Tetrastichus* that attacks *X. morigerus*, but as the latter decreased, parasitism of *X. morstatti* also decreased, and when *X. morstatti* was present almost exclusively, no more parasites were usually to be found. Later on a parasite of *X. morstatti* appeared, which, though indistinguishable from the one already mentioned, did not attack *X. morigerus*.

Cryptolaemus montrouzieri, Muls., was bred and liberated against *Pseudococcus citri*, Risso, and other mealybugs attacking coffee. Solar oil was found to be superior to petroleum for controlling these Coccids. *Coccus* (*Lecanium*) *viridis*, Green, was harmful in a few plantations only, and infestation by the coffee berry borer [*Stephanoderes hampei*, Ferr.] was generally slight. The importation of its parasite, *Heterospilus coffeicola*, Schmied., from Uganda was continued.

KABURAKI (T.). **On the Biotic Potential of the Rice Borer,** *Chilo simplex* **Butler.**—*Proc. Imp. Acad.*, viii, no. 6, pp. 264–266, 6 refs. Tokyo, June 1932.

A mathematical formula is given for determining the biotic potential [*R.A.E.*, A, xviii, 416] of *Chilo simplex*, Butl., which is very destructive to rice and occurs in various parts of Asia. It is based on the rate of reproduction and sex ratio. The fecundity of the insect, although presenting a wide range of variations with individuals, is relatively high, experiments showing an average of 310 eggs deposited per female, with a minimum of 7 and a maximum of 952. The rate of development varies considerably in different localities. In Formosa there are 4 generations a year, whereas in Hokkaido and the Aomori prefecture only one is the rule.

[POPOV (P. V.).] **Попов (П. В.). Keys to the Pests of Cotton identified by the Damage caused and by their injurious Stages.** [*In Russian.*]—Med. 8vo, 48 pp., 50 figs. Moscow, Nauchno-issledov. Inst. Khlophovod. [Sci. Res. Inst. Cott. Cult.], 1931. Price 85 *kop.* [Recd. August 1932.]

In this handbook, keys are given to the Arthropods (almost all of which are insects) attacking cotton in the Russian Union, based on the type of damage caused and the morphological characters of the injurious stage, with brief notes on their distribution and economic importance. A list is given of 119 pests, showing their importance

in the different cotton-growing areas. One chapter contains instructions for carrying out field observations at various periods of the year, and another deals with the collection, preparation and transport of insects and plant specimens.

[Yakhontov (V. V.).] **Яхонтов (В. В.). The Fauna of the Invertebrates feeding on the Cottonplant. (Areas of the Distribution of different Species in the World.)** [*In Russian.*]—*Proc. Sci. Res. Inst. Cott. Cult. Ind. & Irrig.* (*NIHI*), no. 39, 94 pp., 59 maps, 18 pp. refs. Moscow, 1931. Price 4 *rub.* 35 *kop.* [Recd. August 1932.]

This work contains a list of the numerous invertebrates, most of which are insects, recorded in various parts of the world as injurious to cotton, including the stored material and seed, arranged alphabetically and with their synonyms. Notes are given on their distribution and economic importance, the character of the injury and the part of the plant attacked. A comprehensive bibliography is arranged in groups corresponding to the main continental regions where cotton is grown, and sketch-maps show approximately the areas of distribution of the more important pests.

In the preface, V. V. Nikol'skiĭ emphasises the importance of safeguarding cotton areas from the introduction of pests.

[Talitzkiĭ (V. I.).] **Талицкий (В. И.). Keys for the Determination of the Pests of Maize in the U.S.S.R. and the Injuries caused by them.** [*In Russian.*]—Cr. 8vo, 72 pp., 50 figs., 11 refs. Moscow, Sel'kolkhozgiz, 1932. Price 60 *kop.*

This popular handbook on the more important insect pests of maize in the Russian Union is based partly on the literature and partly on the author's observations. It contains keys for the determination of the pests in the stage in which they attack the plant, based on their morphological characters and the injury caused. Brief notes are given on the bionomics and control of the chief pests, with a list of the 123 species that have been recorded on maize in the Russian Union, showing their distribution and degree of economic importance.

Aldrich (J. M.). **New Diptera, or two-winged Flies, from America, Asia, and Java, with additional Notes.**—*Proc. U.S. Nat. Mus.*, lxxxi, art. 9, no. 2932, pp. 1–28, 1 pl. Washington, D.C., 1932.

The new parasitic Muscoid flies, here described, include : *Sarcophaga* (*Blaesoxipha*) *valangae*, reared from the locust, *Valanga nigricornis*, Burm., in Java, *Leskiomima jaynesi* from *Diatraea saccharalis*, F., in Argentina, *Schistochilus* (gen. n.) *aristatum* from *D. striatalis*, Sn., in Java, *Zenillia palpalis* from *Castnia licoides*, Boisd., in British Guiana, *Trophops* (gen. n.) *clauseni* from *Popillia japonica*, Newm., in Japan, and *Exoristoides urichi* and *Achaetoneura nigripalpis* from the pupae of *Calpodes ethlius*, Cram., in Trinidad. *E. johnsoni*, Coq., is recorded as having been reared from *Gryllus abbreviatus*, Serv., in South Dakota, and *G. assimilis*, F., in California, and *E. slossonae*, Coq., from *Epilachna corrupta*, Muls., in Alabama.

McKay (M. B.) & Dykstra (T. P.). **Potato Virus Diseases. Oregon Investigations 1924–1929.**—*Bull. Oregon Agric. Expt. Sta.*, no. 294, 40 pp., 17 figs., 27 refs. Corvallis, Ore., January 1932.

A detailed account is given of investigations on different methods of transmitting potato virus diseases, conducted in Oregon during 1924–29.

The following is taken from the authors' summary :—In experiments with Aphids, *Myzus persicae*, Sulz., transmitted crinkle mosaic, rugose mosaic, leaf-rolling mosaic and leaf-roll but not mild mosaic. *Macrosiphum gei*, Koch (*Illinoia solanifolii*, Ashm.) transmitted leaf-rolling mosaic and leaf-roll ; in the case of the latter it proved a less efficient vector than other Aphids ; it failed to transmit mild, crinkle or rugose mosaic. *Macrosiphum* (*Myzus*) *pelargonii*, Kalt., transmitted leaf-rolling mosaic and leaf-roll but not mild mosaic, crinkle mosaic or rugose mosaic. *Myzus circumflexus*, Buckt., transmitted crinkle mosaic, rugose mosaic and leaf-roll ; it failed to transmit mild mosaic. Rugose mosaic passed from diseased to healthy plants in insect-proof field cages in the apparent absence of insects of any kind on the parts above ground.

Woglum (R. S.), La Follette (J. R.), Landon (W. E.) & Lewis (H. C.). **Handbook of Citrus Insect Control for 1932.**—*Bull. California Fruit Gr. Exch.*, no. 9, 25 pp. Los Angeles, Cal., July 1932.

The situation with regard to some of the more important insect pests of *Citrus* in California and Arizona is discussed, with recommendations for their control during 1932. During the previous year the total areas under *Citrus* that were fumigated, sprayed and dusted were 50,000, 83,000 and 26,000 acres respectively.

The following is largely taken from the authors' conclusions. Investigations on the causes of failure in navel oranges during 1932 showed that navel end water rot was one of the factors responsible for the trouble. The disease was largely confined to eastern Los Angeles County in which it has been present in greater or smaller degree in 4 out of 8 seasons since oil sprays began to be widely used, and orchards treated with petroleum oils suffered as a whole decidedly more from fruit failure during February-March than fumigated or untreated ones [but *cf. R.A.E.*, A, xv, 604]. Extensive orchard counts made between 22nd February and 10th March in two districts, where weather conditions during the winter were generally comparable, showed that the total loss due to cullage averaged 10 per cent. in fumigated or untreated orchards as against 24 per cent. in those where spraying with oil had been carried out. With the heavier oils in emulsion form, losses were usually more severe than with lighter oils, and groves treated with tank-mixed sprays as a whole showed a small increase in navel water rot, as compared with groves sprayed with commercial emulsions ; the former, however, carried more oil than emulsions as generally used although it was lighter. The time of applying the sprays, whether early or late in the season, did not appear to influence the degree of severity of water rot, regardless of the type or brand of oil used. This apparent lack of seasonal influence in the case of the disease differs from that observed in other respects, such as blossoming, colouration, etc., where the effects of late season spraying are usually more serious than those of early season applications. Heavily sprayed orchards with large, closely planted trees

suffered more severely than those with small well separated ones receiving light applications, and smooth, thin-skinned varieties were more severely affected than rough, thick-skinned ones. It is pointed out that in view of the deleterious influence of oil sprays on navel oranges and the fact that the control of the red scale [*Chrysomphalus aurantii*, Mask.] is a more serious problem than that of the black scale [*Saissetia oleae*, Bern.] in eastern Los Angeles County, an increase in the use of fumigation in the case of this variety would appear to be justified. The use of oil sprays should by all means be avoided in the case of thin-skinned, smooth varieties. A table showing the analyses of oil spray emulsions and spray oils made by the California State Department of Agriculture is appended.

Loftin (U. C.). **Summary of Work on the Pink Bollworm.**—*Rep. Virgin Is. Agric. Expt. Sta., St. Croix, 1931*, pp. 19–20, 2 figs. Washington, D.C., U.S. Dept. Agric., May 1932.

Although sea island cotton has not been grown commercially in St. Croix, Virgin Islands, for several years, partly on account of the damage done to it by *Platyedra* (*Pectinophora*) *gossypiella*, Saund., a survey conducted during 1931 showed the insect to be present in considerable numbers wherever wild cotton occurs. It was also observed on okra [*Hibiscus esculentus*], which is grown by the natives for food, *H. vitifolius*, and *Thespesia populnea*. It is hoped to reduce the numbers of *Platyedra* by destroying all wild cotton on the Island, and declaring a 2- or 3-year close season before planting cotton again.

Knowlton (G. F.). **Notes on Injurious Utah Insects—1931.**—*Proc. Utah Acad. Sci.*, ix, pp. 79–83. Salt Lake City, 1932.

Insect pests occurring in Utah in 1931 included the following less commonly reported species: The Membracid, *Campylenchia latipes*, Say, *Agromyza scutellata*, Fall., and the sawfly, *Sterictiphora lineata*, Rohw., on lucerne, *Empoasca filamenta*, De Long, on potatoes, the Psyllid, *Arytaina ribesiae*, Crwfd., on currants, *Anuraphis viburnicola*, Gill., on snowballs [*Viburnum*], *Thecabius populiconduplifolius*, Cowen, on poplar, *Hylastes* (*Hylastinus*) *obscurus*, Marsh., on clover, and the Ortalid, *Tetanops aldrichi*, Hend., and *Phytometra* (*Autographa*) *falcigera*, Kby. (celery looper) on sugar-beet.

Cardinell (H. A.) & Gaston (H. P.). **Comparisons of Methods of making Spray Applications.**—*Spec. Bull. Michigan Agric. Expt. Sta.*, no. 220, 25 pp., 14 figs. East Lansing, Mich., May 1932.

Part of the information contained in this bulletin, which describes comparative tests of a number of spraying methods carried out in Michigan between 1924 and 1927, has already been noticed [*R.A.E.*, A, xv, 69].

Whereas good commercial control of insect pests of fruit trees can be obtained by any of the commonly employed methods if reasonable care is taken to effect thorough and timely coverage, a considerable saving of time and material can be effected with one man operating from the top of the spray tank as compared with two working together. As operating pressures are increased from 200 to 800 lb., there is naturally a relatively greater use of the fine adjustment of the spray gun, and the time required thoroughly to cover the tree

decreases slightly. With increases in pressure up to 500 lb. there is a tendency to apply more spray material to the tree, but as the pressure is increased above that point there is a tendency to use less. The advantages accruing from the use of very high pressures, above 400 or 500 lb., do not offset their disadvantages. A range of 300–400 lb. appears to be most satisfactory.

Heavily pruned trees require slightly less spray material than lightly pruned or unpruned ones, but with modern spraying equipment operated at usual pressures, good coverage is obtained more or less regardless of the amount of thinning out of the tops of the trees, and pest control is not materially promoted by such pruning. No significant differences in pest control or spray injury were found between plots sprayed during the day and those sprayed at night. Resort to night spraying at critical times, or to enable more timely application, is therefore recommended. Dusting was found to be between two and three times as rapid as spraying and gave essentially the same control of pests, though the cost was somewhat less, owing to the higher cost of materials being offset by one-fourth less labour. Where the water supply was at a considerable distance from the orchard, the rate of coverage could be nearly doubled by providing a supply tank to haul water. This was furthermore accompanied by a decrease rather than an increase in the cost of application per tree.

Service and Regulatory Announcements January-March 1932.—*U.S. Dept. Agric. P.Q.C.A.*, S.R.A., no. 110, pp. 1–24, 1 map. Washington, D.C., June 1932.

Recent revisions and amendments to existing quarantine orders of the United States, which are given verbatim, include an announcement (P.Q.C.A. 328) relating to the European corn borer quarantine No. 43, which states that all stages of *Pyrausta nubilalis*, Hb., that may be present in sweet maize in the milk or dough stage of maturity can be killed by freezing the maize and holding it at certain low temperatures. The authorised method of sterilisation consists in subjecting the maize to freezing temperatures and, after it is frozen, cooling it until it is at or below 0°F. and holding it at or below that temperature for a period of 8 days from the time that all maize in each part of the package reaches that temperature [*cf. R.A.E.*, A, xx, 527]. If at any time during the holding period, any of the maize is found to be above 0°F., the maize in the container or lot will not be certified as having been sterilised until it has been maintained at such specified low temperature for at least 8 consecutive days. It is suggested that the maize be treated in small containers of not more than a bushel capacity to facilitate handling and accessibility to inspectors. This treatment is not applicable to seed maize that is mature or that has passed through the dough stage, as it is not certain whether all instars of the larvae of *P. nubilalis* present in such maize would be killed by it.

An announcement relating to the Mexican fruit worm quarantine No. 64 (P.Q.C.A. 329) authorises the sterilisation of grapefruit subject to quarantine for *Anastrepha ludens*, Lw., by heating the fruit to 110°F. or above (not exceeding 112°F.) in the approximate centre of the fruit and maintaining this temperature for a period of 8 hours. As the required temperatures cannot be reached by means of dry heat without injury to the fruit, live steam should be applied in such a way as to secure as nearly as possible a uniform distribution of steam-heated air so directed as not to discharge directly on to the fruit. In successful

tests, the fruit was placed in field boxes stacked four high without special means of separating those in each stack. Fruit should be sterilised after colouring and before packing for shipment and should be cooled to about 45°F. as soon as possible after sterilisation. Wax or paraffin, either dry or in solution, should not be applied to this fruit either before or after sterilisation. Sterilisation is not being considered as a means of authorising movement of infested fruit, which will be promptly destroyed, but applies to areas believed to be entirely free from infestation to eliminate residual risk after intensive inspection.

Further administrative instructions (P.Q.C.A. 330) relating to the same quarantine authorise the sterilisation of grapefruit and oranges by refrigeration. The method prescribed consists of cooling until the approximate centre of the fruit reaches a temperature of 30–31°F. and keeping the fruit at that temperature for 15 days.

Ewing (H. E.). **Notes on the Taxonomy of three economic Species of Mites, including the Description of a new Species.**—*Proc. Biol. Soc. Wash.*, xlv, no. 27, pp. 99–102. Washington, D.C., 15th July 1932.

The American form of Tarsonemid mite attacking strawberries is stated to be *Tarsonemus pallidus*, Banks.

Mites from a greenhouse used for experiments in South Dakota were identified as *Eriophyes tenuis*, Nal., this being a new record of an introduced harmful species. They destroyed all the wheat in the greenhouse and then attacked barley and flax.

Locustacarus locustae, sp. n., is described from the air sacs of *Locusta migratoria migratorioides*, Rch. & Frm., in Tanganyika Territory.

Swezey (O. H.) & Pemberton (C. E.). **Entomology.**—*Rep. Comm. Expt. Sta. Hawaiian Sugar Pl. Ass. 1930–31*, pp. 19–32, 8 figs. Honolulu, 1932.

Some of the information in this report has already been noticed [*R.A.E.*, A, xx, 225]. As the discovery of additional parasites of *Rhabdocnemis obscura*, Boisd. (cane borer) appears unlikely, cultural measures must be depended upon for its control in areas in which it still persists, such as the choice of suitable varieties and the practice of short cropping in areas where injury has been found to be severe in cane left standing for a long period before harvesting. The control of rats is also of importance as oviposition occurs more readily in the presence of damage done by them. A few heavy outbreaks of *Spodoptera mauritia*, Boisd., and *Cirphis unipuncta*, Haw., occurred on sugar-cane during the year. Fields in which *Spodoptera* was abundant were infested with nutgrass [*Cyperus rotundus*], on which the young caterpillars feed. Hand-collection of the egg-clusters on the cane leaves proved the most effective method of preventing further broods. Parasitism by *Telenomus nawai*, Ashm., was not observed.

Studies by F. A. Bianchi indicated that parasitism of *Anomala orientalis*, Waterh. (cane root grub) by *Scolia manilae*, Ashm., becomes effective during the latter half of the year, and since the parasite does not readily enter large cane, many grubs present in cane which closes in before September are not attacked and often multiply considerably before it is finally cut. *S. manilae* apparently does not leave areas in which it has developed until the cane closes in. In the absence of certain weeds, however, the adults may be expected to leave the fields in search of food, and their preservation and maintenance is therefore of importance.

The parasite [*Anagyrus* sp.] of the pink sugar-cane mealybug [*Trionymus sacchari*, Ckll.] introduced from the Philippines has become established in a few places and gives good promise of controlling this pest. The general scarcity of *Bactra truculenta*, Meyr. (nutgrass moth) is attributed to the presence of *Trichogramma minutum*, Riley [*cf.* xviii, 588]. *Athesapeuta cyperi*, Mshl. (nutgrass weevil) has spread very slowly, but has been found well established in one place.

The report includes an account by C. E. Pemberton of investigations made in other countries during the year in connection with the biological control of Hawaiian sugar-cane pests [*cf.* xx, 23].

Stevens (F. L.). **Two Fungous Invasions often following the Coconut Leaf Miner,** *Promecotheca cumingii* **Baly.**—*Philip. Agric.*, xxi, no. 2, pp. 80–82, 2 figs., 1 ref. Laguna, P. I., July 1932.

Descriptions are given of the fungi, *Pestalozzia palmarum* and *Epicoccum cocos*, sp. n., attacks by which in the Philippines are frequently centred round wounds caused by the oviposition of *Promecotheca cumingi*, Baly, on coconut leaves.

Katsumata (K.) & Kitagawa (S.). **On the Life-history of** *Agrotis tokionis*. [*In Japanese.*]—*Insect Wld.*, xxxvi, nos. 4–5, pp. 120–124, 163–166. Gifu, April–May 1932.

The Noctuid, *Agrotis tokionis*, Butl., all stages of which are briefly described, is a pest of onion in Japan, and also feeds on radish, turnip, etc. In Ishikawa-Ken, there is one generation a year, the larvae passing the winter, usually in the third instar, on the lower surface of leaves near the ground. Pupation occurs in August and September, the adults emerging at the end of September and early in October. Oviposition begins 2 or 3 days after emergence and continues for 3–10 days. About 900 eggs are laid, and they hatch in 11–14 days. In the first instar, the larvae feed during the day, but when older they do so only at night. The full-grown larvae enter the soil, where they gnaw the roots of the food-plants and remain underground for 72–103 days before pupation. The larvae moult six times, and the pupal stage lasts 18–37 days.

Hotari (S.). **On the Control of** *Bruchus rufimanus*. [*In Japanese.*]—*Insect Wld.*, xxxvi, nos. 4–5, pp. 124–129, 166–169. Gifu, April–May 1932.

Exposure of beans to the sun for 3 or 4 days between the middle of July and the beginning of August kills all stages of *Bruchus rufimanus*, Boh., in them and does not affect their germination. Soaking the beans in water at a temperature of 65–70°C. [149–158°F.] for 5 minutes is also very effective, but heating at 70°C. for 20 minutes slightly affects the germinating power of the beans, though it kills the Bruchids.

Masaki (J.). **Morphological and ecological Notes on** *Rhabdophaga salicis* **Schr. I and II.** [*In Japanese.*]—*Insect Wld.*, xxxvi, nos. 5–6, pp. 146–154, 183–191, 1 pl. Gifu, May–June 1932.

Descriptions are given of all the stages of *Rhabdophaga salicis*, Schr., which produces galls on willow (*Salix*) in the southern half of Korea

and in Japan. In Korea it has one generation a year, hibernating as a larva, and the adults, which live 2–6 days, emerge in April and May after a pupal stage of 9–12 days. Oviposition takes place 1 or 2 days after emergence, females laying an average of 130 eggs on the young buds. The larvae hatch in 7–9 days.

KARIYA (M.). **On the Scientific Name of a Species of *Tipula* injurious to the Rice Plant in Japan.** [*In Japanese.*]—*Insect Wld.*, xxxvi, no. 6, pp. 195–201. Gifu, June 1932.

The species of *Tipula* attacking rice in Japan is *T. aino*, Alexander. It has been recorded incorrectly as *T. praepotens*, Wied. [*R.A.E.*, A, xii, 466] and *T. parva*, Lw. [xvii, 343].

KING (C. B. R.). **Report of the Entomologist** [for 1931].—*Bull. Tea Res. Inst. Ceylon*, no. 8, pp. 20–29. Kandy [1932].

It is thought that parasites may be the only effective means of controlling both tortrix [*Homona coffearia*, Nietn.] and the nettle grubs on tea in Ceylon, and therefore as many species as possible should be introduced for the purpose. Some measure of success has been achieved in rearing *Trichogramma erosicornis*, Westw., the egg-parasite of *Homona*, on *Corcyra cephalonica*, Staint. *Ephestia cautella*, Wlk., the host employed in the previous year [*R.A.E.*, A, xix, 574], and *E. kühniella*, Zell., a consignment of which was received from England, failed to breed in the laboratory. *T. erosicornis* was frequently found in the field, occurring in up to 6 per cent. of the egg-masses of *Homona*. It is hoped to introduce a stock of *T. minutum*, Riley, for trial, and adequate cold storage arrangements have now been made for its reception.

The species of nettle grubs previously reported [xix, 573; xx, 496–498] were again troublesome. Some further details of their life-histories are given. *Cantheconidea* (*Canthecona*) *robusta*, Dist., was present in numbers, both the nymphs and adults preying on *Natada nararia*, Moore. The eggs of this Pentatomid are found on the leaves, and the nymphal period lasts from 23 to 28 days; adults have been observed to live for 3 weeks. Wilt disease was a supplementary factor in control, and was even found in two instances to have attacked the larvae of *Natada* before they were two or three weeks old and therefore before they were capable of causing defoliation. It is suggested that collections of nettle grubs and cocoons made during June, July and August, when parasites are plentiful, should be placed in mesh boxes that would allow the parasites to escape. Mites, particularly *Tarsonemus translucens*, Green (yellow mite) were prevalent on tea in some districts, even after a sunless season with heavy rainfall; with the coming of sunshine this mite quickly disappeared. Mites are usually considered dry weather pests, but this outbreak was apparently due to the effect of the adverse season on the plants.

NORRIS (D.). **A Report on the State of Lac Cultivation and the general Condition of the Lac Industry in Burma. November-December 1931.**—Roy. 8vo, 26 pp., 1 fig. Namkum, Ranchi, Indian Lac Res. Inst. [1932]. Price *As.* 8.

An account is given of a tour of some of the lac-producing districts of Burma. The general methods of cultivation were observed to be

elementary, and a scheme for the introduction of improved ones in the Shan States is recommended. A list of the food-plants of the lac insect [*Laccifer lacca*, Kerr] is given.

In an appendix, P. M. Glover states that examination of various samples, mainly from the monsoon crop of 1931, shows the post monsoon swarming period to occur between mid-September and the end of October. The main reason for the long swarming period is the general dependence on natural inoculation. Various predators were observed, of which the Noctuid, *Eublemma amabilis*, Moore, and the Tineid, *Holococera pulverea*, Meyr., are the most important. The adults emerge during February-March, and the larvae continue to damage the lac after it has been cut (September–October) and is in storage. Where material is left on the tree for natural inoculation, the moths emerge at a time when the new crop is sufficiently advanced to be attacked. Another Tineid, *Pyroderces* (*Anatrachyntis*) *falcatella*, Staint., damages the lac in the field and in storage by tunnelling through the resinous cell walls to obtain access to the females, which constitute its principal food. This is probably the first record of this species from lac in Burma. A single cocoon of *Chrysopa* sp. was obtained from a sample of lac. It is suggested that some form of fumigation should be practised against these pests, or that all lac should be scraped and ground immediately it is cut from the tree and if possible washed. Other recommendations [*cf. R.A.E.*, A, xvii, 348; xix, 600] include the abolition or restriction of natural inoculation, particularly from September to October.

Glover (P. M.), Negi (P. S.), Misra (M. P.) & Gupta (S. N.). **The Effects of Temperature and Humidity on Oviposition, Incubation and Emergence, in the Lac Insect,** *Laccifer* (*Tachardia*) *lacca*, **Kerr (Coccidae), and on the resulting Lac Crop.**—*Bull. Ind. Lac Res. Inst.*, no. 6, 18 pp., 13 refs. Calcutta, 1932. Price *Rs.* 1·4.

Detailed experiments in India on the possibility of delaying the emergence of the larvae of *Laccifer lacca*, Kerr, from brood lac show that the transport of material nearing the oviposition period over distances taking 9–10 days is possible at a temperature of 59–62·6°F., with no considerable harm to the fertility or vitality of the females. The premature cutting of the crop and the danger of emergence during transit if it is cut late may thus be avoided. Oviposition should not have begun before dispatch.

Oviposition and emergence of the larvae will be delayed if the temperature during the egg-laying period is unfavourable (below 64·4–68°F.), as it sometimes is during February–March. Emergence may be induced, however, by tying the brood to the plants in the sunlight, if the day temperature is above 68°F. If the brood is kept at 75·2–82·4°F., emergence will occur, but it will cease on removal to the field unless the temperature there exceeds 68°F. It can be re-induced by returning the material to a high temperature. Subjecting the brood to a temperature of 35·6–55·4°F. for 1–4 days will result in continuous emergence 2–3 days after its return to the field.

Oviposition, incubation and hatching are unaffected by humidity within the range of 58–100 per cent.

THAKUR (A. K.). **Comparative Study of Lac Hosts with special Reference to** *Acacia catechu* **and** *Cassia florida*.—*Bull. Ind. Lac Res. Inst.*, no. 9, 8 pp., 5 refs. [Nankum, Ranchi] 1932. Price *As.* 8.

Investigations are described which show that the acidity and density of the sap are of possible importance in influencing the suitability of a food-plant for infestation with the lac insect [*Laccifer lacca*, Kerr]. In the case of *Cassia florida*, the amount of available food material and the seasonal periods of growth offer no explanation of its unsuitability.

[POPOV (P. V.).] **Попов (П. В.). The Outbreaks of** *Epitetranychus althaeae* **v. Hanst. in Central Asia in Connection with the meteorological Conditions.** [*In Russian.*]—*Proc. Sci. Res. Inst. Cott. Cult. Ind. Irrig.* (*NIHI*), no. 51, 23 pp., 3 graphs, 2 refs. Moscow, 1931. Price 50 *kop.* (With a Summary in English.) [Recd. August 1932.]

An account is given of a study of the relation between meteorological conditions and the occurrence of the red spider, *Tetranychus telarius*, L. (*Epitetranychus althaeae*, v. Hanst.), which is an important pest of cotton in Central Asia. Investigations on its distribution in the various cotton-growing areas in 1927–29 showed that Uzbekistan was the most severely infested region ; serious outbreaks occurred there in 1927 and 1929. The chief damage is caused from about the last week in July to the first half of September, during which period the infestation rapidly covers large areas. In the following fortnight it does not spread further, though there is an increase of injury in the infested fields. The mites disappear from the cotton plants by the end of September, but the dropping of the leaves and bolls continues for about three weeks afterwards. A detailed analysis is given of such meteorological factors as temperature, atmospheric humidity and wind in the cotton-growing areas in Uzbekistan and Turkmenistan in 1927–29, on the basis of which the author suggests that outbreaks of *T. telarius* depend on the incidence of a temperature of 26–29°C. [78·8–84·2°F] at a relative humidity of 23–26·5 per cent. These conditions are found in Uzbekistan, whereas the dry and hot desert winds in Turkmenistan are an important limiting factor, as they lower the humidity to an extent that is detrimental to the mites. Low winter temperatures have no effect on outbreaks. In Central Asia a definite relation exists between the meteorological conditions of successive summer months, and the probable average temperature and humidity in a certain month may be determined by those of the preceding one ; it may be possible, therefore, to predict an outbreak of *T. telarius* a month or six weeks in advance.

NEUWIRTH (F.). **Schädlinge und Krankheiten der Rübe im Jahre 1931.** [Pests and Diseases of the Sugar-beet in 1931.]—*Z. Zuckerind. čsl. Repub.*, 1931–32, pp. 345–349, 353–357 ; also in *Listy cukrovarnické*, l, p. 321 ; and in *Ber. ForschInst. čsl. Zuckerind. Prag*, XXXV, pp. 223–231, 1 diag., 11 refs. Prague, 1932.

The insects observed on beet in Czechoslovakia in 1931 have been recorded in previous reports [*R.A.E.*, A, xx, 258, 479]. Especially serious damage was caused in Slovakia by *Euxoa* (*Agrotis*) *segetum*, Schiff., which in some districts destroyed 80–100 per cent. of the beet plants and also severely injured millet [*Panicum miliaceum*] and maize.

Deep ploughing of infested fields in the year following an outbreak is recommended, together with the introduction of poultry. In autumn beet should be sown as late as possible, after the larvae have already entered hibernation, whereas in the spring it should be sown early so that the plants may be fairly advanced when the cutworms resume feeding. The application of kainit to the soil in wet weather successfully prevents them from attacking the plants. Of the larvae collected in various districts, 5–10 per cent. were parasitised by *Paniscus opaculus*, Thoms., and 15–25 per cent. by *Meteorus* sp.

The larvae of the beet-fly, *Pegomyia hyoscyami* var. *betae*, Curt., were particularly abundant at the end of May, and the resulting adults oviposited in the last week of June, but the eggs failed to hatch, having probably been killed by very hot weather. In some districts the adult flies were successfully controlled by catching them on a wire net with meshes 3–5 mm. wide, coated with an adhesive. The net is mounted on a rectangular frame, to the lower side of which a strip of sacking is fixed ; and the frame is carried in a vertical position, slightly inclined forward, through the infested field, so that the canvas lightly sweeps the beet plants and disturbs the flies.

THIEM (H.). **Methoden und Ergebnisse der Anfälligkeitsuntersuchungen gegen Reblaus in den staatl. Rebenprüfstellen zu Iphofen und Ingelfingen.** [Methods and Results of Investigations at the State Vine Testing Stations of Iphofen and Ingelfingen on the Susceptibility of Grape-vines to Attack by *Phylloxera*.]—*Wein u. Rebe*, xiii, no. 9, reprint 27 pp. Mainz, 1932.

An account is given of the investigations with grafted and direct-bearing grape-vines conducted since 1920 by the German Imperial Biological Institute to ascertain their susceptibility to attack by *Phylloxera*. Some grafted stocks have been found of which the roots have failed to become permanently infested even in the most favourable field conditions.

THIEM (H.). **Zur innertherapeutischen Schädlingsbekämpfung bei Pflanzen.** [On the internal Treatment of Plants.]—*Die Gartenbauwiss.*, v, no. 1, pp. 55–90, numerous refs. Berlin, 1931. [Recd. August 1932.]

A detailed account is given of experiments at Naumburg on the effect of internal treatment with nicotine of grape-vines infested with the leaf-form of *Phylloxera*. There are also brief notes on similar work with nicotine and other substances against Coccids on other plants. The results, which were unsatisfactory, have already been briefly noticed [*R.A.E.*, A, xix, 725].

THIEM (H.). **Eine rote Kommaschildlaus der deutschen Coccidenfauna (*Lepidosaphes rubri* n. sp.).** [A red German Mussel Scale, *L. rubri*, sp. n.]—*Die Gartenbauwiss.*, v, no. 6, pp. 557–567, 10 figs., 13 refs. Berlin, 1931. [Recd. August 1932.]

Descriptions are given of the male, female and larva of *Lepidosaphes rubri*, sp. n., a scale found in June 1929 on *Carpinus betulae* near Naumburg. It hibernates as an adult female and probably reproduces sexually, whereas *L. ulmi*, L., for which it has apparently been often

mistaken, hibernates in the egg-stage and is thought to be parthenogenetic. Both species have one generation a year. It is possible that many records of males of *L. ulmi* are referable to *L. rubri*.

THIEM (H.). **Der gefurchte Dickmaulrüssler** (*Otiorrhynchus sulcatus* **F.**) **als Gewächshaus- und Freilandschädling. (Zuchtergebnisse über Parthenogenese, Eiablage und Lebensdauer.)** [*O. sulcatus* as a Greenhouse and Field Pest. The Results of Breeding Experiments on Parthenogenesis, Oviposition and Longevity.]—*Die Gartenbauwiss.*, vi, no. 5, pp. 519–540, 2 figs., 20 refs. Berlin, 1932.

In breeding experiments with *Otiorrhynchus sulcatus*, F., at Naumburg, the parthenogenetic reproduction of this weevil was experimentally proved. The data obtained regarding the length of the life-cycle indicate a duration of 1 year in countries with a long vegetation period, such as the south of France, whereas in regions with shorter vegetation periods, such as parts of Germany, 2–4 years may be required. The maximum number of eggs laid by a female was 1,000, with an average of 550–600. The maximum number of eggs laid in a year was 950. The egg-stage varied with the temperature from 3 to 6 weeks, and the pre-oviposition period of the adults from 45 to 125 days. Oviposition continues from May to September in the second year of life; in the first year its duration depends on the date of emergence. The most fertile females die immediately after oviposition is completed; less fertile ones continue to live for a few weeks. The maximum duration of adult life was 33 months, and the average 17.

SÉGUY (E.). **Études sur les Anthomyides. 6e note. Notes biologiques et taxonomique sur les mouches de l'oeillet.**—*Encyc. ent.*, Sér. B, II, Dipt., vi, pp. 71–81, 13 figs., 9 refs. Paris, 1932.

Notes are given on the bionomics and distribution of *Hylemyia brunnescens*, Zett., and *H. cardui*, Mg., two Anthomyiids attacking carnations in France. *H. fugax*, Mg., which has been recorded on spinach, is said to attack carnations in Holland, but has never been observed by the author on either wild or cultivated carnations in France. All three species are described, with a list of 6 other Anthomyiids attacking caryophyllaceous plants.

SÉGUY (E.). **Contribution à l'étude des mouches phytophages de l'Europe occidentale.**—*Encyc. ent.*, Sér. B, II, Dipt., vi, pp. 145–197, 6 pls., 21 figs., 46 refs. Paris, 1932.

In the biological part of this paper on the phytophagous flies of western Europe, notes are given on the food-plants and distribution of various species of economic importance, including a number of Trypetids.

GAHAN (C. J.). **Furniture Beetles.**—*Econ. Ser. Brit. Mus.* (*Nat. Hist.*), no. 11, 3rd edn., 30 pp., 1 pl., 10 figs. London, 1932. Price 6*d*.

This is the third edition, revised and enlarged by F. Laing, of a pamphlet already noticed [*R.A.E.*, A, viii, 443; xiii, 294]. Additional information includes a section on the natural enemies of the furniture

beetles and notes on the use of various substances, such as varnish, for closing the pores of the wood against oviposition, and on preventive measures to be observed in timber-yards against *Lyctus*.

METCALFE (M. E.). **On a suggested Method for determining the Number of larval Instars in** *Sitodrepa panicea* **L.**—*Ann. Appl. Biol.*, xix, no. 3, pp. 413–419, 1 fig., 5 refs. Cambridge, August 1932.

A number (887) of larvae of *Sitodrepa panicea*, L., were examined with a view to testing the possibility of estimating the number of larval instars by measuring the head capsules of a random population. Applying the principle laid down by Dyar that the rate of growth of successive instars, as measured by the increasing growth of the head capsule, is in regular geometrical progression [*cf. R.A.E.*, A, xvii, 178], it was found that the measurements obtained fell into two groups, one slightly larger than the other, the growth ratios of which approximated to two geometrical series, one with a common ratio of 1·12, the other with a common ratio of 1·11. It is suggested that these two groups represent the sexes, and on this hypothesis it would appear that the males undergo a minimum of four larval ecdyses, and the females a minimum of five.

Owing to the inadequate number of larvae obtained, no satisfactory conclusions with regard to the number of the early instars can be reached, and the analysis of the data is further complicated by the variation in size and presumed overlapping of the instars in both sexes. Such a method of determining the number of larval instars in a given insect can be of only doubtful value until much larger and more representative populations can be examined.

MILES (H. W.). **On the Biology of the Apple Sawfly,** *Hoplocampa testudinea* **Klug.**—*Ann. Appl. Biol.*, xix, no. 3, pp. 420–431, 3 pls., 10 refs. Cambridge, August 1932.

Field and laboratory observations on *Hoplocampa testudinea*, Klug, the larvae of which infest the fruitlets of apple, have been carried out in Lancashire and Cheshire since 1928. From data obtained in these studies, mating and oviposition are described and an account is given of the position of the eggs in the apple blossoms. They are usually found under the epidermis of the upper surface of the receptacle within the calyx ring, and often within the bases of the stamens. The incubation period normally varied from 8 to 15 days, during which period the eggs increased slightly in size and the majority ruptured the epidermis of the receptacle and so became partly exposed within the calyx ring. The larvae emerge from the eggs on the outside of the fruitlet and proceed to penetrate it either from within the calyx ring or by passing over the calyx on the side of the receptacle and tunnelling in from that position. Although all the larvae appear to seek the ovary, numbers of them never reach it and some larval mortality may occur at this stage. Circular or ribbon scars appear to be caused by the wanderings of the first instar larvae in their first penetration of the fruit. Fruitlets attacked by first instar larvae seldom contain more than one, but fruit entered by migrating larvae may contain two or three. The larvae, which are described, overwinter in cocoons, most of those observed being constructed at a depth of 3–9 inches in the soil. The pupal period lasts 3–4 weeks. Notes are given on infestation by

H. testudinea in relation to a number of apple varieties, and results obtained by other workers in attempts to control it by sprays of lead arsenate or soap and nicotine [*R.A.E.*, A, xii, 505 ; xvii, 255] are discussed.

From a study of the biology it appears that control measures must be directed against the larva before it is able to penetrate the fruit. Since the egg is usually partly exposed on the upper surface of the receptacle during the later stages of incubation, and the larva escapes from the egg on to the receptacle, it seems apparent that the spray must be timed and applied so that it reaches the surface of the fruit within the calyx ring. It should be applied before rather than after the hatching of the larvae, but it seems essential that it should not be applied until after the petals have fallen in order to ensure that the spray fluid penetrates the calyx cup. It is probable also that the relation of the sepals to the calyx cup and the filaments to the surface of the receptacle after the fall of the petals may be of significance, for the temporary closing of the sepals after flowering and the drawing inwards of the filaments would afford some measure of protection to the eggs and hatching larvae.

READ (W. H.). **The Toxicity of the Vapours of volatile organic Compounds to the "Red Spider" Mite** (*Tetranychus telarius* **L.**) **Part I. Some aliphatic Alcohols and their Formic Esters.**—*Ann. Appl. Biol.*, xix, no. 3, pp. 432–438, 18 refs. Cambridge, August 1932.

Although the insecticidal values of esters of several aliphatic alcohols have been determined in connection with stored products [*R.A.E.*, A, xiii, 178, etc.], the alcohols themselves have received little attention. The esters are of considerable insecticidal importance since ethyl formate is used in fumigating certain food products and patents covering the use of esters of formic acid have been granted in several countries. Experiments have therefore been carried out to determine the relative toxicities of the vapours of the homologous series of aliphatic alcohols and their formates to *Tetranychus telarius*, L., in relation to their chemical and physical properties.

The following is the author's summary: With the exception of methyl formate, which is the most toxic of the formates tested, the toxicity towards *T. telarius* of the normal aliphatic alcohols and their formates at first increases as the series is ascended. The normal compounds are more toxic than their isomers, the toxicity decreasing with increased branching of the chain. The above decrease is greatest when the branching is at the α position to the hydroxyl or carboxyl group. The relative effects of the compounds on plants are similar to their effects on the mite, but the differences due to molecular structure are more pronounced.

PROVASOLI (L.). **Contributo alla biologia ed all'embriologia della** *Galerucella luteola* **(F. Müller) e del suo endofago** *Tetrastichus xanthomelaenae* **(Rond.).** [A Contribution to the Biology and Embryology of *G. luteola* and its endophagous Parasite, *T. xanthomelaenae*.]—*Boll. Lab. Zool. Milano*, iii (1930–31), fasc. 1, pp. 53–66, 3 figs. Milan, 1932.

Descriptions are given of the changes in colour of the adult, egg and larva of *Galerucella luteola*, Müll., a pest of elms in Italy, and of the

development of the embryo. Eggs parasitised by *Tetrastichus xanthomelaenae*, Rond., or those from which the parasites have emerged are a pale hazel in colour and opaque, and the exit-holes in the latter have irregularly gnawed edges, whereas the shells of eggs from which the beetle larvae have hatched are white and transparent and the edges of the exit-holes are bent outwards.

Colizza (C.). **La Grillotalpa. Sue Abitudini e metodi per combatterla.** [The Mole-cricket. Its Habits and Methods for combating it.]—*Boll. Lab. Zool. Milano*, iii (1930–1931), no. 1, pp. 151–155. Milan, 1932.

A short account is given of the habits of the mole cricket [*Gryllotalpa gryllotalpa*, L.] and of various measures employed against it. From his tests in Italy the author concludes that poison baits, including the zinc phosphide formula now largely advised in that country [*R.A.E.*, A, xx, 257, etc.], have no appreciable effect on the damage done to the plants in infested plots. For small plots excellent results are obtained by pouring a spoonful of lubricating oil into each hole, and then flooding it with water. The mole-cricket soon emerges and dies of suffocation by the oil. On the evening preceding treatment, the ground should be raked over to close all holes, as those in actual use are then re-opened during the night.

Morris (H. M.). **Annual Report of the Entomologist for 1931.**—*Ann. Rep. Dept. Agric. Cyprus 1931*, pp. 48–52. Nicosia, 1932.

Insect pests recorded in Cyprus during 1931, other than those mentioned in the previous year's report [*R.A.E.*, A, xx, 101], included an unidentified thrips that was injurious on melons during the latter part of May, *Cocus hesperidum*, L., on *Citrus*, *Ceroplastes rusci*, L., on figs and oranges, *Prodenia litura*, F., on potato, *Vanessa* (*Eugonia*) *polychloros*, L., on peas, *Omophlus propagatus*, Kirsch., on the flowers of olive, and *Adoretus pullus*, Baudi, on the leaves of almond.

Dociostaurus maroccanus, Thnb. (Moroccan locust) was much less numerous than it has been for several years, possibly owing to cold weather accompanied by heavy rain at the end of March, when it was in the early stages of its development.

Harris (W. V.). **Report of the Assistant Entomologist.**—*Ann. Rep. Dept. Agric. Tanganyika 1930*, pp. 49–52. Dar-es-Salaam [1932].

Insects recorded on cotton in Tanganyika Territory include the Capsid, *Helopeltis bergrothi*, Reut., on the flower and young shoots, the Lamiid, *Tragocephala variegata*, Bert., on the stems, and the Coreid, *Anoplocnemis curvipes*, F., the Cetoniid, *Diplognatha silicea*, Macl., the Pyrrhocorids, *Dysdercus intermedius*, Dist., and *D. superstitiosus*, F., and the Pentatomids, *Hotea subfasciata*, Westw., *Macrorhaphis spurcata*, Wlk., and *Nezara viridula*, L. var. *torquata*, F., all on the bolls. Owing to the sudden cessation of the rains and the absence of showers in June, the plants were slow in putting forth new flowers and the damage caused by the early bollworms, particularly *Heliothis* (*Chloridea*) *obsoleta*, F., was more noticeable than usual. *Platyedra gossypiella*, Saund., was unusually abundant, partly owing to the lateness of the crop due to the destruction of the buds by *Earias* spp., which also caused a large amount of damage to the flowers, and to the delay in

planting flooded areas. The rapid increase of *P. gossypiella* during November indicates the value of early maturity for cotton. *Dysdercus* spp. were exceptionally scarce, there being no occurrence of the usual heavy infestation in October and November. Pests of food-crops included *Laphygma exempta*, Wlk., on maize and millet [*Sorghum*], Rutelids attacking the roots of rice, and *Ootheca bennigseni*, Wse., on early sown leguminous plants.

A study has been commenced of the Psyllid, *Phytolyma lata*, Wlk., which owing to the injury it causes to *Chlorophora excelsa*, one of the most valuable timber trees, is rendering difficult the reafforestation of certain areas. It attacks the leaves and shoots during the dry season, causing defoliation, deformation and death in extreme cases. The nymphal stage is passed within a gall and lasts about 3 weeks. Various reports were received of swarms of *Nomadacris septemfasciata*, Serv. (red-winged locust). The swarming phase of this locust has not been reported since 1901.

NEWMAN (L. J.). **The Pea Weevil** (*Bruchus pisorum*, **Linn.**).—*J. Dept. Agric. W. Aust.*, (2) ix, no. 2, pp. 297–300, 2 figs., 1 ref. Perth, W.A., June 1932.

An account is given of the bionomics and control of *Bruchus pisorum*, L., on peas in Australia, where it has become established in several areas in the south-west. Though some damage is caused to the peas in the field, the greatest economic loss results from the continued development of the larvae in storage. Infestation never spreads in the store, however, as the eggs are only laid when the peas are green and in the pod.

The adults emerge after December and seem to undergo aestivation. Some may become active early in the winter, but the majority appear in early spring. A total of 25–30 eggs are laid on the pods, hatching normally occurring in about 21 days in the spring. The larva immediately bores through the pod into a developing seed, in which it remains for about 3 months, undergoing a pupal period of an additional 3 weeks. It is considered that this Bruchid is distributed by infested seeds, which should never be sown [but *cf. R.A.E.*, A, xviii, 483 ; xix, 578]. Cultural methods of control include early sowing and harvesting of the peas, rotation of crops and the maintenance of pigs or poultry on infested land, which should subsequently be thoroughly ploughed. Peas in storage should be kept in sound bags, securely tied to prevent emergence of the adults. Soaking the peas for 5 minutes in a mixture of 2 parts boiling water to 1 part cold water is probably the most economical method of killing the larvae in small amounts of seed, but fumigation of the crop after harvest for 48–60 hours with carbon bisulphide at the rate of 3 lb. to 1,000 cu. ft., is the most effective measure. For treating small quantities of peas, 1 fl. oz. carbon bisulphide should be used in a 25 gallon barrel, which will hold a 200 lb. bag of seed.

BOX (H. E.). **Sugar-Cane Moth Borer** (*Diatraea*) **Investigations in Antigua.**—*Bull. Imp. Inst.*, xxx, no. 2, pp. 185–197. London, July 1932.

This is a report for 1931 of observations in connection with *Diatraea saccharalis*, F., the only species of the genus known to occur in Antigua,

where it feeds indiscriminately on sugar-cane and maize. The eggs are attacked by *Trichogramma minutum*, Riley, and *Telenomus* (*Prophanurus*) *alecto*, Cwfd., and the larvae by the fungus, *Cordyceps barberi*. Considerable doubt is, however, expressed as to whether control of *D. saccharalis* in cane-fields is possible by means of artificially reared *Trichogramma*, since investigation showed that in no case could a low percentage of attack be attributed to a high percentage of parasitism by the latter. It is proposed to import into Antigua the Cuban parasite of the larva, *Lixophaga diatraeae*, Towns., which appears to offer one of the most promising methods of control.

The author discusses the methods of planting and the susceptibility to attack of different varieties of cane. The practice of growing maize between the rows of canes and allowing old maize stalks to dry out in the field encourages infestation of the canes by the borer. Ecological factors in Antigua are of particular importance as regards its presence, and work is in progress to investigate the problem from an ecological standpoint. Besides sugar-cane, maize and guinea-corn [*Sorghum*], the borer has been found in Antigua in 8 species of wild grasses ; it appears to be rather a question of the association in which the plant occurs than the species that determines whether a grass is attacked.

Borden (A. D.). **Codling-moth Bait Traps.**—*Circ. California Agric. Extens. Serv.*, no. 63, 13 pp., 5 figs. Berkeley, Cal., April 1932.

A general account is given of the use of bait traps as an indication of the correct time to apply sprays of lead arsenate for the control of *Cydia* (*Carpocapsa*) *pomonella*, L., on apple in California. The application of three sprays timed according to data obtained from the traps resulted in a minimum of injury in the spring of 1929 and of 1930, whereas the two usual spring treatments did not prevent severe infestation and considerable loss. Two types of containers are described [*R.A.E.*, A, xviii, 68 ; xix, 477], and their correct position in the trees is given [xvii, 721]. A bait of 1 U.S. pint molasses, 9 U.S. pints water and 1 cake yeast (compressed) has been used with success. In 1929, however, a malt syrup (Diamalt) was found to be superior to the molasses in that it is always uniform in composition, ferments more readily and is more efficient during periods of high temperature ; it may be used at the rate of 1 U.S. pint to 19 U.S. pints water and 1 cake yeast (compressed). In New Mexico the substitution of 0·2 per cent. sodium benzoate [*cf.* xx, 27] for yeast increases the effectiveness of the bait. In a field test carried out from July to September with syrups of malt, maize and cane used with yeast or sodium benzoate, a bait of malt syrup and yeast was the most effective during low temperatures and one of cane syrup and sodium benzoate during high temperatures. The average mean temperature of the coastal region of California (60°F. during the experiments) is probably too low for the successful use of sodium benzoate, but it may prove more advantageous in the valleys in the interior.

Late varieties of apple and pear usually show the greatest amount of moths caught and are best for trap trees. In orchards of up to 40 acres, 8 or 10 traps are sufficient. They should remain in the field from the first week in April to the end of June for the first brood, and from the end of June to the time of harvest in September or October for the second. The containers usually require refilling every 5th or 7th day, according to the rate of evaporation of the liquid. At least 1 U.S. quart of material is needed in each container and 1½ is often better.

Brief descriptions are given of the injurious moths that may be attracted to the bait. It is suggested that individual records might be replaced by records for the district obtained from selected orchards and posted daily on notice boards.

Borden (A. D.). **The Pear Leaf Blister Mite as a Cause of Fruit-bud Injury.**—*Circ. California Agric. Expt. Sta.*, no. 324, 8 pp., 3 figs. Berkeley, Cal., April 1932.

The damage to pear consisting of dead fruit buds during the winter, weak flowers at blossom time and russeted, misshapen fruit at harvest, caused by the depredations of a mite morphologically identical with *Eriophyes pyri*, Pag., has increased considerably in California during the past few years, and the appearance of similar injury to apples in a district in the north-west of the State in 1931 has augmented the economic importance of the problem. The author does not consider this mite to be specifically distinct from the ordinary form of *E. pyri*, which causes leaf-blisters on apple and pear, though he describes how it differs greatly in biology and in the type of injury it causes [*cf. R.A.E.*, A, xvii, 73, 228; xx, 408]. It appears that the predatory mite, *Seius pomi*, Parrott, is of importance in controlling infestations.

Experiments were undertaken in the autumn of 1930 with various sprays, and the most satisfactory were again tried in 1931. Lime-sulphur at the rate of 7½ and 10 per cent. killed the mites outside the buds and a few in the looser buds early in the autumn, and a combination of 5 per cent. lime-sulphur and a 2 per cent. emulsion of light oil (having a viscosity of 65 seconds Saybolt and an unsulphonated residue of 90 per cent.) gave satisfactory control with a minimum of buds destroyed the following winter. Applications should be made during the migratory period of the mite, which varies considerably in different localities, occurring earlier at high altitudes. Applications early in the autumn usually kill the immature stages of Coccids and the eggs of the brown mite [*Bryobia praetiosa*, Koch] so that the usual dormant treatment may be omitted. Pruning the new growth terminals and the sucker growth in the interior of the tree undoubtedly removes many of the mites infesting the terminal buds and leaf axils.

Smith (L. M.). **The Shot Hole Borer.**—*Circ. California Agric. Extens. Serv.*, no. 64, 13 pp., 6 figs., 3 refs. Berkeley, Cal., April 1932.

A general account is given of the bionomics and control of *Scolytus rugulosus*, Ratz. (shot hole borer) in California, where it attacks various stone fruit trees. The larvae hibernate in the inner bark and pupate during the winter or early in the spring. Oviposition occurs from late March to late October, and there are probably three generations and a partial fourth a year.

The trees should be kept strong and vigorous to enable them to withstand attack, sufficiency of soil moisture being the chief factor conducive to this. Clean cultivation is important in the orchards, and all dead wood removed from the trees during the autumn and winter should be burned before the end of February.

Mackie (D. B.). [Report of the] **Division of Entomology and Pest Control.**—*Mon. Bull. Dept. Agric. California*, xx (1931), no. 12, pp. 745–761. Sacramento, Cal., 1932.

In California several years of abnormal climatic conditions have seriously reduced the natural water supplies, causing the drying up of

various plants and the migration of a wide range of usually innocuous insects to cultivated crops. Trees are weakened and unable to resist the attacks of certain insects that feed on the wood and the bark and are normally unable to injure them, such as *Scolytus rugulosus*, Ratz., which has caused considerable damage to prunes and apricots [*cf.* preceding paper]. Moreover, favourable weather conditions resulted in the migration from the south of various insects, which have appeared and bred in the State for the first time ; of these *Laphygma frugiperda*, S. & A., caused considerable damage to maize and slight damage to cotton in 1931, and another Noctuid, *Erebus odora*, L., was taken on a black acacia [*Robinia*]. It appears likely, however, that both insects will be killed by the low temperatures in winter.

Tibicen apache, Davis, appeared early in the summer and caused considerable damage to young *Citrus* and asparagus by slitting the tender growth during oviposition. *Anagrus epos*, Gir., a parasite of the eggs of *Erythroneura comes*, Say (grape leafhopper) was numerous during August. Entire areas of almonds were defoliated by *Bryobia praetiosa*, Koch (*pratensis*, Garm.). The bean thrips [*Hercothrips fasciatus*, Perg.] caused extensive damage to cotton. Investigations show that commercial damage by *Listroderes obliquus*, Gyll., occurred primarily on carrots and turnips, and to a less degree on spinach, in cases where they were planted on or adjacent to land on which the same crops or a preferred wild food-plant, such as mallow or aster, had grown in the previous season.

The citrus whitefly [*Dialeurodes citri*, R. & H.] was found in Santa Ana, and it is estimated that 450,000 U.S. gals. spray and about 6,000 lb. hydrocyanic acid for fumigation purposes will be necessary for its eradication. In the work against the walnut husk-fly [*Rhagoletis suavis completa*, Cress.], 64,000 lb. of a 5 per cent. nicotine dust were applied with uniform success, no infested nuts being found in the treated area. Infestation, however, was found to have occurred outside and to the rear of the operations. As the result of a survey, *Ephestia figulilella*, Gregson, was discovered on 17 varieties of grapes, causing serious local damage, and the lesser apple-worm [*Enarmonia prunivora*, Walsh], for the first time in the State, on the fruit of wild rose (*Rosa californica*). *E. figulilella* has apparently only twice been previously recorded in the United States, in each case as a pest of raisins. A heavy infestation of Catalina cherry moth [*Cydia latiferreana*, Wlsm.] occurred on cultivated walnuts.

Sprays of water at high pressure are effective in controlling the European elm scale [*Gossyparia spuria*, Mod.] on elms whether dormant or in leaf, and experiments were carried out in Sacramento with sprays of water, lead compound and copper compound to determine whether the streams might cause contact between wires carrying electric currents of high voltages. The negative results obtained were apparently due to the breaking of the stream into minute globules by the pressure from which it was released. In experiments to discover a treatment for the prevention of date offshoots from carrying Marlatt scale [*Phoenicococcus marlatti*, Ckll.] the use of oils of low viscosity resulted in considerable injury and low mortality, whereas heavy oils caused no injury and gave a mortality of 100 per cent., for the first time since the initiation of the project. The oils were applied under pressure, using a preliminary 29½ inch vacuum to remove the air from the interspace between the leaf-bases.

Considerable infestations of the granary weevil [*Calandra granaria*, L.] occurred in barley stored for three or more years while awaiting exportation in local warehouses.

Fleury (A. C.). [Report of the] **Division of Quarantine Administration.**—*Mon. Bull. Dept. Agric. California*, xx (1931), no. 12, pp. 793–806. Sacramento, Cal., 1932.

Pests intercepted in California during 1931, other than those mentioned in the previous year's report [*R.A.E.*, A, xix, 690], included: *Porthetria dispar*, L., on ornamental plants, *Cydia* (*Grapholitha*) *molesta*, Busck., on flowering cherries, *Chilo simplex*, Butl., in rice straw, and *Prontaspis yanonensis*, Kuw., on *Citrus* fruits, all from Japan; *Aleurocanthus woglumi*, Ashby, on mango plants from the Philippine Islands; *Cylas formicarius*, F., from China, the Straits Settlements and the Philippines, *Omphisa anastomosalis*, Guen., from China, and *Euscepes batatae*, Waterh., from Fiji and the West Indies, all in sweet potatoes; *Maruca testulalis*, Geyer, in string beans from Japan, Tahiti and the Orient; *Prays citri*, Mill., in oranges and grapefruit from Java; *Aulacaspis pentagona*, Targ., on various food-plants from Japan and Italy; *Epidiaspis* (*Diaspis*) *pyricola*, Del G., on apple scions from Italy; *Prontaspis citri*, Comst., on *Citrus* fruits from Brazil, Tahiti, China and Panama; and *Selenaspidus articulatus*, Morg., on coconuts and *Citrus* fruits from Central America, the West Indies and Texas.

Smith (R. H.). **The Tank-mixture Method of using Oil Spray.**—*Bull. California Agric. Expt. Sta.*, no. 527, 86 pp., 27 figs. Berkeley, Cal., May 1932.

Much of the information contained in this detailed account of the results obtained in the use of tank-mixture spray applied over a period of 5 years to *Citrus* in California, has already been noticed [*R.A.E.*, A, xviii, 210, 481; xix, 216; xx, 26]. A brief history of the use of oil sprays and of the origin and development of the tank-mixture method is given. The insecticidal efficiency of oil sprays and their harmful effects on trees are discussed, and the generally accepted idea that oil must be emulsified in order to be used for spray purposes is shown to be erroneous. The subject of spray-tank agitation in commercial spray practice is investigated, and an account is given of experiments carried out with various methods of agitation and of the power required to operate agitators. The results of studies of various mixtures during passage through the spray hose are shown, and the relation of the size of oil globules to insecticidal efficiency of oil sprays is indicated. The factors governing the quantity of oil deposited are discussed, and methods for determining such quantities are described. Tests were carried out to determine the amount of oil deposited on sections of glass by proprietary emulsions, and that deposited on orange leaves by similar emulsions and by tank mixtures; and finally orchard tests showed the quantity of oil deposited as indicated by leaf-drop on orange and lemon trees and by degree of scale-insect control. The function of spreaders and emulsifiers in oil sprays is discussed, and an account is given of experiments with oil sprays in the control of the black scale [*Saissetia oleae*, Bern.], citricola scale [*Coccus pseudomagnoliarum*, Kuw.] and red scale [*Chrysomphalus aurantii*, Mask.]. The advantages of the tank-mixture method are indicated, and recommendations are

given for the preparation and application of various grades of spray, taking into consideration effectiveness of control, safety to the tree and cost, and the relation of these three factors to a wide variety of conditions.

PETERSON (A.). **Are Entomologists becoming "Insecticide minded?"** —*J. N. Y. Ent. Soc.*, xl, no. 2, pp. 159–165. New York, June 1932.

As a result of a study of the budgets of entomological institutions in the United States, the author concludes that much more work on insecticides is in progress to-day than 15–20 years ago. An examination of the papers in the *Journal of Economic Entomology* for the years 1909–11, 1914–16, 1919–21, 1924–26 and 1929–31 showed that the percentage of papers on insecticides appearing from 1924 to date was twice as great as the percentage of those from 1909 to 1916. In view of the fact that the latter periodical might be considered to be largely devoted to work published on insecticides, the contents of entomological papers from the United States abstracted in Series A of this *Review* in 1915, 1920, 1925 and 1930 were also examined, and it was found that the percentage of papers on insecticides for 1925 and 1930 was nearly twice as great as that for 1915 and 1920.

JONES (H. A.). **Rotenone, a promising new Insecticide.**—*Hexagon Alpha Chi Sigma*, xxii, no. 6, pp. 276–280, 1 pl. Indianapolis, Ind., March 1932.

This general review deals briefly with the plants from which rotenone is obtained, the method of its extraction, its characteristics, and its toxicity to insects.

WILCOX (J.), GRAY (K. W.) & MOTE (D. C.). **The Strawberry Crown Moth.**—*Bull. Oregon Agric. Expt. Sta.*, no. 296, 30 pp., 12 figs., 19 refs. Corvallis, Ore., May 1932.

An account is given of the bionomics and control of *Aegeria* (*Synanthedon*) *bibionipennis*, Boisd., on strawberry in western Oregon, and all stages are described. Some of the information on its life-history is similar to that already noticed [*R.A.E.*, A, xviii, 210]. It is also known to attack raspberries and blackberries. The larvae hibernate in the crown of the strawberry plant, and pupate late in the following spring, the adults occurring in late June and July. The younger larvae feed on the outside and the older ones inside the crown of the plant. The larvae are usually most numerous during August-September, when on an average 20–30 may be found in one plant. Natural enemies include *Microbracon nevadensis*, Ashm., which in 1929 was found parasitising 34·8 per cent. of the larvae (the highest percentage observed), and the Tachinid, *Parafischeria venatoris*, Coq., which infested 20 per cent. of pupae collected in the field in the same year.

The following is taken from the author's summary: Although experiments have shown that topping and covering the plants with straw is of value in preventing infestation, the effects of these measures on the growth and yield of the plants are not definitely known. Topping consists in the cutting of the leaves, stems, runners and old fruit spurs from the plants immediately after harvest and just before the moths emerge. The time of emergence can be predicted by an examination

of the pupae, since the colour of the adult can be seen through the pupal case for a few days previously. Seven-eighths of the field should be topped and the remainder left untouched; the position of the untopped rows in the field does not appear to be important. During heavy infestations all the untopped plants, and during light infestations those that are heavily attacked, should be ploughed up and destroyed in September or October. If it is necessary to remove an old planting that adjoins a patch of young plants, the latter should be topped and the plants in the old patch left untopped until the autumn when they should be ploughed up and destroyed. Topped plants may be covered with straw as an additional control measure.

Robinson (R. H.). **Arsenical Spray Residue on Cherries.**—*Bull. Oregon Agric. Expt. Sta.*, no. 298, 15 pp., 1 fig. Corvallis, Ore., May 1932.

The continued infestation of cherries in Oregon by the cherry fruit-fly [*Rhagoletis cingulata*, Lw.] has necessitated one or more applications of a lead arsenate and molasses bait-spray. Experiments during 1930–31 to determine the amount of arsenical residue remaining on the fruit at harvest showed that in some cases it exceeded the 0·01 grain tolerance. The type of spray, the amount used, and the rainfall that subsequently occurs largely determine the quantity of residue remaining. In a dry season it might prove necessary to clean the fruit before it would be allowed to be sold, but in general it is probable that heavy showers lasting several hours will reduce the arsenical residue well below the amount allowed.

Tentative recommendations are given on the technique and methods of cleaning the fruit, with details on the construction of washing and rinsing tanks. Preliminary tests showed that little difficulty was experienced in removing the residue in view of the smooth and wax-free surface of the fruit, and that the molasses contained in the spray assisted in the removal, since it dissolved rapidly, thus releasing the lead arsenate. Of a number of solvents tested, 0·3 per cent. hydrochloric acid was the most effective. Washing the fruit in the solution for about 3 minutes successfully removed the residue. The fruit should be allowed to stand for 1–2 hours after picking and 2–3 hours if rain has fallen overnight, before washing. In a commercial fruit washing machine of the jet type the cherries were effectively washed by all solvents tested, and water gave practically as good results as the strongest solvents. The washing processes employed in canneries also proved effective in reducing the residue.

Division of Entomology.—*41st Ann. Rep. Washington Agric. Expt. Sta. 1930–31* (Bull. no. 260), pp. 30–34. Pullman, Wash., December 1931. [Recd. August 1932.]

The results of most of the observations on injurious insects and other pests in Washington discussed in this report have already been noticed from other sources. A. Spuler states that *Leptocoris trivittatus*, Say (box-elder bug) caused considerable damage to apples in one locality. No external injury to the fruit, which was the only part of the trees attacked, was visible, but darkened areas developed under the skin at the points where it had been punctured by the bugs. This discolouration extended to a depth of $\frac{1}{4}$ to $\frac{3}{8}$ inch, and was continuous where

punctures were numerous. Of a number of contact poisons tested, a spray of pyrethrum extract and fish-oil soap (1 : 1 : 400), applied early in the morning or late in the evening, when the bugs are more or less quiescent, gave the best results. Those hit by the spray fell to the ground, where they finally died.

Webster (R. L.), Baker (W. W.) & Hanson (A. J.). **Potato Flea-beetles in Washington.**—*Bull. Washington Agric. Expt. Sta.*, no. 261, 20 pp., 12 figs., 10 refs. Pullman, Wash., April 1932.

Much of the information in this paper on *Epitrix cucumeris*, Harr., and *E. subcrinita*, Lec., attacking potatoes in Washington has been previously noticed [*R.A.E.*, A, xix, 656, etc.]. In 1931 a systematic effort was made to protect the foliage and tubers by applying various dusts and sprays at intervals of 10 days, the primary object being the determination of the most effective insecticide rather than the formation of a programme of control for the entire season. A dust of sodium fluosilicate and lime (1 : 3) gave the highest degree of protection, but caused slight injury to the foliage. Barium fluosilicate appears to be the most promising material, and its use is recommended as a dust with the addition of lime (1 : 3), or as a spray at the rate of 1½ lb. to 50 U.S. gals. water. Calcium arsenate, 1½ lb. to 50 U.S. gals. Bordeaux mixture (4–4–50), may also be used. Investigations are in progress to determine the minimum number of applications necessary to ensure control.

Henderson (W. W.). **Crickets and Grasshoppers in Utah.**—*Circ. Utah Agric. Expt. Sta.*, no. 96, 38 pp., 20 figs., 45 refs. Logan, Utah, November 1931. [Recd. August 1932.]

Detailed quotations are made from contemporary accounts of the earliest recorded attacks of *Anabrus simplex*, Hald., and grasshoppers in Utah, and a popular description is given of 20 of the more important grasshoppers and crickets occurring in the State, together with particulars of the methods employed for destroying them.

Buchanan (L. L.). **A new Barine Curculionid injurious to Sugar-cane in Louisiana with Synopses of** *Anacentrinus* **and** *Oligolochus* **(Coleop).**—*Ann. Ent. Soc. Amer.*, xxv, no. 2, pp. 328–336, 2 figs.

Hinds (W. E.) & Osterberger (B. A.). **Sugarcane Rootstock Weevils.** *T.c.*, pp. 337–343, 1 pl., 3 refs. Columbus, Ohio, June 1932.

In the first paper, *Anacentrinus subnudus*, gen. et sp. n., is described from sugar-cane in Louisiana, and keys are given to the species of *Anacentrinus* (including most of those included by Casey in his genus *Anacentrus*) and *Oligolochus*, Csy. (*Anacentrus, sens. str.*), with notes on the new synonymy.

In the second paper the authors report that the failure to establish a stand of first year stubble of sugar-cane over a large area in Louisiana was found to be due to serious infestation of the root-stocks by weevils. Further examination, in September, showed that the weevils were widely distributed throughout the cane-growing districts of the State, and that all stages, except the eggs, were present in the field. Two species, and not one as heretofore supposed [*cf. R.A.E.*, A, xix, 94], were responsible for the damage. They were *Anacentrinus subnudus* and *A.* (*Anacentrus*) *deplanatus*, Csy., the latter being the less abundant,

Previous to being recorded on sugar-cane, *A. deplanatus* had only been known to attack wild grasses, particularly *Echinochloa crus-galli*, which is widely distributed throughout the State. In addition to sugar-cane *A. subnudus* was found breeding in roots of maize, and to a certain extent in *Sorghum* and *Paspalum boscianum*. It seems probable that no particular type of soil is entirely free from infestation by these weevils, though there is some indication that certain types may be more heavily infested than others. Plant cane was also found to be attacked, though the damage caused is less evident ; in pieces of cane dug in December from a plot planted in October, almost 20 per cent. of the eyes had been destroyed by *Anacentrinus*. Up to December 1931, the weather was unusually warm, the minimum temperature being 34°F. Under these conditions the growth and pupation of larvae continued steadily and the adults were numerous and active.

Drake (C. J.) & Decker (G. C.). **Late Fall Activity and Spring Emergence of the Hessian Fly in Iowa.**—*Ann. Ent. Soc. Amer.*, xxv, no. 2, pp. 345–349, 2 graphs, 5 refs. Colombus, Ohio, June 1932.

Unusual weather conditions in Iowa during the summer of 1930 produced abnormal irregularities in the seasonal development of the Hessian fly [*Mayetiola destructor*, Say]. Studies on the emergence of the flies have been carried on since 1922 for the purpose of forecasting the fly-free date for sowing winter wheat [*cf. R.A.E.*, A, xii, 304, 491], and during most of this period, with the exception of slightly unseasonable dry and wet spells that produced light secondary waves of spring and autumn emergence, the biotic conditions have been almost normal and the two-brood cycle has largely prevailed. In the summer and autumn of 1930, however, only light local rains occurred during an unprecedented drought, though in certain localities some rain occurred at favourable periods, causing an untimely wave of early emergence during late summer and early autumn. In addition the usual emergence of the autumn brood was slightly delayed and incomplete and was later followed by a large supplementary emergence of flies during the first 20 days in October, the progeny of which continued to develop throughout the rest of the winter. These late emerging flies issued largely from late summer and early autumn broods, and to a less extent from the first larvae completing development of the normal autumn brood together with a few remaining from the spring brood. The effect of the unusual climatic conditions on the seasonal development of the fly in Monona County from the spring of 1930 to that of 1931 is discussed in some detail.

Balch (R. E.) & Simpson (L. J.). **A European Sawfly (*Diprion polytomum*, Hartig) attacking Spruce in the Gaspe Peninsula, Que.** —*Canad. Ent.*, lxiv, no. 7, pp. 162–163. Orillia, Ont., July 1932.

Widespread injury to spruce due to the sawfly, *Diprion polytomum*, Htg., was observed in November 1930 in the Gaspe Peninsula, Quebec ; in some areas most of the foliage had been eaten and about 10 cocoons to the square foot were found in moss and litter on the ground beneath the trees. A biological investigation of the outbreak was undertaken in 1931, and an aeroplane survey showed that over 2,000 square miles were infested. The damage was confined to the old foliage of white and black spruce [*Picea glauca* and *P. mariana*], especially the former,

of which there are some very fine stands in the region that are in a seriously weakened condition from the loss of foliage. The bark-beetle, *Dendroctonus piceaperda*, Hopk., had already killed some six per cent. of these trees, and itself increased considerably in numbers during 1931. The occurrence of *Diprion polytomum* in North America apparently passed unnoticed until this outbreak, though it seems to have established itself over a very extensive area. No parasites have as yet been found, but shrews and mice destroy numbers of the cocoons. Many larvae were killed by the early snows at the higher altitudes, and this may be a cause of considerable mortality. There is only one generation in a year in the Gaspe Peninsula. The eggs are deposited singly in the needles throughout July and early August and hatch in about 10 days, and the larvae are on the trees from July to September, when hibernation begins. In 1921 about 75 per cent. of the over-wintered larvae remained dormant throughout the summer in the prepupal stage, and this probably increases the likelihood of a continuance of the outbreak.

Twinn (C. R.). **The Occurrence of the Odd Beetle and a brief Note on other Dermestid Species in Canada.**—*Canad. Ent.*, lxiv, no. 7, pp. 163–165, 8 refs. Orillia, Ont., July 1932.

The occurrence of the Dermestid, *Thylodrias contractus*, Motsch., in Canada, where it was found feeding on dried insects at Ottawa is reported. Records of its appearance in the United States are reviewed, and the adults and larvae are briefly described. Other Dermestids recorded in Canada that feed on animal matter and are of actual or potential importance are *Dermestes lardarius*, L., which is a common household pest attacking animal food products; *D. vulpinus*, F., which feeds on meat and other food materials of high protein content; *Attagenus piceus*, Ol., which is a pest of fabrics, furs and other materials of animal origin, and also of cereal products; *A. pellio*, L., which has been reared from carpets; *Trogoderma versicolor*, Creutz., found infesting woollen cloth and cereal products; *T. ornata*, Say, which has been taken in Ontario and has been recorded from the United States as occurring in dwellings and occasionally attacking insect collections; *Anthrenus scrophulariae*, L., which is a wide-spread pest of carpets, clothing and other materials of animal origin; and *A. verbasci*, L., a species of similar habits, which has also been reared on cereals and wood.

Papers noticed by Title only.

Veitch (R.). **Biological Control of Insect Pests** [a popular account].—*Queensland Agric. J.*, xxxvii, pt. 6, pp. 301–303. Brisbane, 1st June 1932.

McDunnough (J. H.). **Directions for Collecting and Preserving Insects.**—*Pamph. Dept. Agric. Canada*, N.S., no. 14, revd. edn., 14 pp., 6 figs. Ottawa, December 1931. [Recd. August 1932.]

Simmons (P.) & Ellington (G. W.). **A Biography of the Angoumois Grain Moth** [*Sitotroga cerealella*, Ol.].—*Ann. Ent. Soc. Amer.*, xxv, no. 2, pp. 265–281. Columbus, Ohio, June 1932.

Gillette (C. P.) & Palmer (M. A.). **The Aphidae of Colorado. Part II.**—*Ann. Ent. Soc. Amer.*, xxv, no. 2, pp. 369–496, 108 figs. Columbus, Ohio, June 1932. [*Cf. R.A.E.*, A, xx, 192.]

Franssen (C. J. H.). **Die Lachninen Javas.** [The Lachninae of Java (including two new species).]—*Natuurhist. Maandbl.*, xxi, no. 7, pp. 89–91, 1 pl. Maastricht, 29th July 1932.

Hille Ris Lambers [D.]. **A new species of** *Chaitophorus* **Koch (Aphid. Homoptera) from** *Chrysanthemum* [*sinense* in Italy], *Chaitophorus chrysanthemi* **sp. n.**—*Boll. Soc. ent. ital.*, lxiv, no. 5, pp. 74–75. Genoa, 20th May 1932.

Kanda (S.). **A new Species of the Genus** *Pseudococcus* [*P. kaiensis* on *Calamagrostis* sp. in Japan].—*Annot. zool. jap.*, xiii, no. 4, pp. 387–390, 9 figs. Tokyo, 5th May 1932.

[Gavalov (I. I.).] **Гавалов (И. И.). Zur Fauna der Cocciden des Don-Gebietes.** [Contribution to the Fauna of the Coccids of the Don Region (20 species with notes on food-plants and local distribution).] [*In Russian.*]—*Trud. Sev.-Kavk. Inst. spetz. i tekhn. Kul'tur* [*Trans. N.-Caucas. Inst. Spec. Techn. Crops*], i, no. 3, pp. 152–154, 6 refs. Krasnodar, 1932. (With a Summary in German.)

[Gavalov (I. I.).] **Гавалов (И. И.). Beiträge zur Kenntnis der Cocciden des Kaukasischen Gebietes.** [Contributions to the Knowledge of the Coccids of the Caucasian Region (56 species with notes on food-plants, local distribution and some parasites, chiefly fungi).] [*In Russian.*]—*Trud. Sev.-Kavk. Inst. spetz. i tekhn. Kul'tur* [*Trans. N.-Caucas. Inst. Spec. Techn. Crops*], i, no. 3, pp. 132–151, 76 refs. Krasnodar, 1932. (With a Summary in German.) [See *R.A.E.*, A, xx, 327.]

Balachowsky (A.). **Contribution à l'étude des Coccides de France (9e note). Sur un** *Luzulaspis* **nouveau des Iles d'Hyères.**—*Bull. Soc. ent. Fr.*, xxxvii, no. 13–14, pp. 197–200, 10 figs., 8 refs. Paris, 1932.

Hall (W. J.). **Observations on the Coccidae of Southern Rhodesia.**—*Stylops*, i, pt. 9, pp. 185–195, 6 figs. London, 15th September 1932.

Eggers (H.). **Neue Borkenkäfer (Ipidae, Col.) aus Africa (Nachtrag IV).** [No food-plants.]—*Rev. Zool. Bot. afr.*, xxii, no. 1, pp. 23–37. Brussels, 1st August 1932. [*Cf. R.A.E.*, A, xv, 521.]

Bridwell (J. C.). **The Subfamilies of the Bruchidae (Coleoptera).**—*Proc. Ent. Soc. Wash.*, xxxiv, no. 6, pp. 100–106. Washington, D.C., June 1932.

Curran (C. H.). **New Species of Trypaneidae, with Key to the North American Genera.**—*Amer. Mus. Nov.*, no. 556, 19 pp., 9 figs., 4 refs. New York, 12th September 1932.

Hodson (W. E. H.). **A Comparison of the Larvae of** *Eumerus strigatus*, **Fln., and** *Eumerus tuberculatus*, **Rond. (Syrphidae).**—*Bull. Ent. Res.*, xxiii, pt. 2, pp. 247–249, 2 figs., 4 refs. London, July 1932.

Hubbell (T. H.). **A Revision of the** *puer* **Group of the North American Genus** *Melanoplus*, **with Remarks on the taxonomic Value of the concealed male Genitalia in the Cyrtacanthacrinae (Orthoptera, Acrididae).**—*Misc. Pub. Mus. Zool. Univ. Michigan*, no. 23, 64 pp., 4 pls., 4 figs., 16 refs. Ann Arbor, Mich., 6th June 1932.

Frappa (C.). **Note sur deux insectes nuisibles au caféier à Madagascar.**—*Bull. Acad. malgache*, N.S. xiii (1930), pp. 125–126. Antananarivo, 1931. [Recd. August 1932.] [*Cf. R.A.E.*, A, xix, 599.]

Entomology.—*26th Ann. Rep. Br. Columbia Dept. Agric. 1931*, pp. U17–U19. Victoria, B.C., 1932.

A great increase in infestation of apples by *Cydia pomonella*, L., occurred in British Columbia in 1931, when as much as 60 per cent. of the fruit was infested in some orchards. A reduction in the quantity of spray used was probably mainly responsible for this increase. A summary is given of the results obtained from the control measures used in various orchards. No advantage was noted from the use of oil sprays. The omission of the second cover spray did not increase the amount of infested fruit. Plots receiving one or more applications of 3 lb. lead arsenate to 80 gals. water in the cover sprays showed distinctly better results than those receiving only 2 lb. An excellent covering was obtained with the use of only 1 lb. commercial spreader to each tank of 240 gals., and fish-oil spreader gave no better results. The results obtained in 1931 indicate the possibility of advancing the date of the second cover-spray to the end of July and the third to early August. In view of the great loss of bees through poisoning with arsenical sprays in areas affected by *C. pomonella*, a search was made for new chemicals to act as repellents and a number were obtained, although too late for tests in 1931. Experiments with cresylic acid prepared in the form of cresoap indicated repellent action, though strengths lower than 3 per cent. did not repel long enough to allow sprays to dry, while the higher strengths caused injury to vegetation.

Eriosoma lanigerum, Hsm., made its appearance in several areas in 1931 and may now be regarded as a permanent apple pest. High pressure spraying (400–500 lb.) is necessary for satisfactory control. Trees subject to perennial canker should be banded with adhesive during May. All cankers should be treated with canker paint in July and the trees kept free from *E. lanigerum* to the end of the season.

Potatoes and onions were again seriously injured by wireworms in several districts. As land planted with lucerne was found to be practically free from wireworms after three years, it is now proposed to test it as a rotation crop.

Spencer (G. J.). *Epidapus scabiei*, **Hopk., as a Greenhouse Pest in Vancouver.**—*Proc. Ent. Soc. Br. Columbia*, no. 29, pp. 19–20. Vancouver, B.C., 1932.

The author records the eradication in a few days of an infestation of *Pnyxia* (*Epidapus*) *scabiei*, Hopk., in greenhouse soil by leaving the soil to dry out, this process being accelerated by raising the temperature and raking the soil deeply at intervals.

Spencer (G. J.). **Further Notes on** *Rhynchocephalus sackeni*, **Will. (Diptera, Nemestrinidae).**—*Proc. Ent. Soc. Br. Columbia*, no. 29, pp. 25–27, 1 ref. Vancouver, B.C., 1932.

Newly-emerged adults of the Cerambycids, *Asemum atrum*, Esch., and *Xylotrechus insignis*, Lec. (*obliteratus*, Lec.), have been observed in British Columbia near freshly-cut holes in dressed telephone poles of fir installed 19 years previously, from which it is thought they emerged. From the fact that *Rhynchocephalus sackeni*, Will., was observed ovipositing in cracks in these poles, it is thought that the larvae parasitise those of the two beetles, or at least those of *X. insignis*.

Beall (G.). **The Life History and Behavior of the European Earwig, *Forficula auricularia*, L., in British Columbia.**—*Proc. Ent. Soc. Br. Columbia*, no. 29, pp. 28–43, 5 diag., 4 refs. Vancouver, B.C., 1932.

An account is given of investigations on the bionomics of *Forficula auricularia*, L. (European earwig), which has become a pest in gardens and houses in Vancouver and neighbouring towns in British Columbia.

In 1929, nymphs were present in the field from the beginning of May till the end of November, being most abundant in the middle of June and the end of July. During the latter period the nymphal instars were only 0·6 as long as in the former; under constant conditions in the laboratory at about 62°F. they occupied 14, 14, 13 and 19 days respectively. The incubation period lasted 31 days. The males attained maturity about a day later than the females and only formed 40 per cent. of the total population in the autumn. In outdoor cages, the earwigs nested freely above ground in paper. It appears that considerable numbers of eggs were laid after the main reproduction period early in the spring. During the winter earwigs were only found in stony banks. An unidentified fungous disease caused severe mortality among adults that had emerged from hibernation. It apparently occurred when relatively high humidities and temperatures coincided.

Quantitative expressions of the relative activity of different groups of earwigs were obtained by a comparison of numbers of each group occurring in accessible traps with numbers in less accessible traps. The nymphs appeared above ground at the end of the first instar and with each following moult became increasingly active in climbing. In the spring the females were more active than the males, and in the autumn the males were the more active. A detailed survey of South Vancouver indicated that the degree of infestation varied directly with the degree of human occupation. On dissection a limited number of earwigs were found to contain the alga, *Pleurococcus*, which occurs in lichen on trees, poles, fences, etc., and it is thought that the nature and importance of the arboreal habit of the earwig may perhaps be connected with the presence of lichen on the trees.

Compere (H.) & Smith (H. S.). **The Control of the Citrophilus Mealybug, *Pseudococcus gahani*, by Australian Parasites.**—*Hilgardia*, vi, no. 17, pp. 585–618, 7 figs., 10 refs. Berkeley, Cal., May 1932.

The citrophilus mealybug, *Pseudococcus gahani*, Green, has been reduced from the status of a serious pest in California to one of almost negligible numbers by the introduction of the internal parasites *Coccophagus gurneyi*, Comp., and *Tetracnemus pretiosus*, Timb., from Australia [*R.A.E.*, A, xx, 22, etc.]. The annual saving in Orange County alone, where more than 40,000 acres of *Citrus* were infested, is estimated at anything from £100,000 to £200,000 (at par). Descriptions of these parasites and an account of their propagation, transport and biology are given, as well as brief notes on the less important enemies found in Australia, *viz.*, *Anusoidea comperei*, Timb., a parasite that was not introduced into California; *Midas pygmaeus*, Blackb., which was introduced and is still maintained in some of the local insectaries and of which colonisations are occasionally made; *Diplosis* sp., which was introduced in 1928 but of which the influence is negligible,

and *Chrysopa ramburi*, Cam., the establishment of which in California is doubtful.

T. pretiosus deposits the majority of its eggs in a few days after emergence, whereas *C. gurneyi* oviposits over a period of about three weeks. After the first week, therefore, some of the ovipositing females of the latter attack mealybugs already inhabited by larvae of *T. pretiosus* or other parasites, or even of its own species. Almost invariably the egg is then placed upon or within the primary occupant. When developing on other parasites, the larvae of *C. gurneyi* grow much faster than when developing on the mealybugs themselves, probably as a result of using food that has already been elaborated by a prior inhabitant of the host.

It has frequently been suggested that it is a mistake to introduce for biological control two or more insects attacking the same stage of the host, as the resulting competition is said to reduce the total effect below that produced by the more prolific species alone. It is not always found, however, that the parasite destroying the greater percentage of a host in its native home is the more valuable one for introduction; *T. pretiosus*, for example, proved the more effective of the two parasites in Australia, while *C. gurneyi* seems to be the more effective in California. The introduction of these two species also provided some interesting data on the practical aspects of the question of multiple introductions. When both are introduced simultaneously into a cage heavily stocked with mealybugs, *C. gurneyi* rapidly becomes dominant and completely eliminates *T. pretiosus*. The percentage of parasitism is then very high, with much overlapping. In the field it is found that if parasites are of any great value they will maintain the mealybug population at a low density, and as the density of the host becomes reduced the percentage of parasitism must be reduced also. The overlapping of the two species is naturally diminished in consequence, so that when the density of the host is low there is a minimum of overlapping and therefore slight effect of one parasite on the other. It seems reasonable to conclude, therefore, that these two parasites are more effective than either alone would have been. Under such conditions, each species destroys host individuals that would have escaped destruction by the other provided that the parasites have slightly different habits and habitats. Moreover, *T. pretiosus* is very scarce during the winter months, whereas *C. gurneyi* is active throughout the cold weather and develops two generations to one of its host, thus materially reducing the numbers of overwintering mealybugs that produce the most injurious spring generation. In places where the mealybugs are protected by ants, *T. pretiosus*, which oviposits very quickly, is less interfered with than the slower *C. gurneyi*.

The percentage of parasitism in thousands of mealybugs collected from various parts of California during the past three years, ranged from 20 to 60 and occasionally reached 100. The actual number of mealybugs destroyed would, however, be considerably higher for many reasons, one of which is the abnormal migration induced by parasitism, which results in many parasitised mealybugs leaving the trees. As, moreover, there are approximately two generations of parasites to one of mealybugs, if 50 per cent. of a given generation of the latter are destroyed by one generation of parasites and 50 per cent. of the survivors by the next, there is a total destruction of 75 per cent. although only 50 per cent. would contain parasites at any one dissection.

It is an important consideration that a high percentage of destruction of an insect by one factor, such as parasites, can be important or unimportant according to whether it replaces or does not replace some other cause of mortality. The percentage of parasitism means little, from the standpoint of control, unless correlated with host population density, yet estimates of parasitism are almost invariably given in percentage of hosts attacked, with no reference to host population density. It is a mistake to assume, because a parasite is destroying only a small percentage of its host when the host is scarce, that the parasite has no important effect on the maintenance of a low host population density ; it may be the critical factor. There is no method known for measuring accurately the quantitive effect of separate environmental factors on the population density of a phytophagous insect. Conclusions must still be based on general field observation, and the contention that the disappearance of injurious infestations of *P. gahani* is due to the work of *C. gurneyi* and *T. pretiosus* is based on the observation that without exception the absence or occurrence of serious infestations of the pest has been positively correlated with the presence or absence of the parasites.

Muesebeck (C. F. W.). **Revision of the Nearctic Ichneumon-flies belonging to the Genus** *Macrocentrus.—Proc. U. S. Nat. Mus.*, lxxx, art. 23, no. 2923, 55 pp., 7 refs. Washington, D.C., 1932

Among the new species described are *Macrocentrus crassipes*, reared from *Sidemia* (*Hadena*) *devastatrix*, Brace, in Montana ; *M. peroneae*, from *Peronea variana*, Fern., in Ottawa ; *M. robustus*, from *Pyrausta nubilalis*, Hb., in Massachusetts ; *M. utilis*, from *P. ainsliei*, Heinr., in Iowa, Kansas, and Indiana ; *M. instabilis*, from *Cydia* (*Laspeyresia*) *molesta*, Busck, in Tennessee, New Jersey, Ohio and Pennsylvania, *C.* (*L.*) *funebrana*, Treit., in Washington, D.C., *Coleophora malivorella*, Riley, in Washington, D.C., and West Virginia, and *Acrobasis* spp. in Texas ; and *M. laspeyresiae* from *Cydia molesta* in New Jersey, *Enarmonia* (*Laspeyresia*) *caryana*, Fitch, in West Virginia and Mississippi, *C.* (*Carpocapsa*) *pomonella*, L., in Virginia, Ohio and Arkansas, and *Acrobasis* sp. in Texas.

Hogetop (K.). **A traça da pereira** (*Eriophyes pyri* **Pagst.) e o seu combate.** [*E. pyri* and its Control.]—*Egatea*, xvii, no. 3, pp. 96–100, 4 figs. Porto Alegre, 1932.

Eriophyes pyri, Pgst., is recorded as a potentially serious pest of pear trees in the Brazilian state of Rio Grande do Sul, and spraying with lime-sulphur or a similar insecticide is advocated.

Gobbato (C.). **A filoxera e a viticultura Riograndense.** [*Phylloxera* and Viticulture in Rio Grande do Sul.]—*Egatea*, xvii, no. 3, pp. 116–118. Porto Alegre, 1932.

The infestation of the roots of vines by *Phylloxera* is now becoming serious in Rio Grande do Sul, Brazil, and the use of resistant stocks is advised.

Franssen (C. J. H.). **Eene nieuwe prepareermethode voor langen tijd in alcohol bewaarde Aphiden.** [A new Method for preparing Aphids kept for a long time in Alcohol.]—*Ent. Ber. Ned. ent. Ver.*, viii, no. 186, pp. 403–404. Amsterdam, 1st July 1932.

Aphids hardened by storage in alcohol for such periods as 20 years can be rendered indistinguishable from fresh preparations by soaking them in a mixture of equal parts by weight of carbolic acid crystals, lactic acid (75 per cent.) and undiluted glycerine for about 2 months in the Tropics and somewhat longer in temperate climates, or in lactic acid (75 per cent.) alone for $1\frac{1}{2}$ months. The material is then warmed in lactic acid in a water-bath.

Balachowsky (A.). **Étude biologique des Coccides du Bassin occidental de la Méditerranée.**—*Encyc. ent.*, Ser. A, xv, 214+lxxi pp., 7 pls., 46 figs., 14 maps, 14 pp. refs. Paris, P. Lechevalier & Fils, 1932. Price *Fr.* 75.

This monograph is the result of the author's studies in North Africa (Algeria, Tunisia, Morocco and the northern Sahara) and the South of France during a period of eight years, and comprises work on 170 known species. It is divided into four parts, including a biogeographical study of the Coccids of North Africa and of the fauna introduced into and acclimatised in the western Mediterranean; a study of the factors governing the Coccid population, including ecological factors and the origin of injurious species; observations on parasitism of Coccids; and a revised catalogue of the North African Coccids and a preliminary list of those occurring in the Maritime Alps, Var, the Delta of the Rhône, the High and Low Alps and Corsica. The Coccid fauna is divisible into two groups, about two-thirds of the total being composed of native species and the rest of introduced species that have become more or less acclimatised. In many cases, the native insect has become adapted to some cultivated plant on which it is far more injurious than on its native host; such is the case with *Lecanium* (*Eulecanium*) *corni*, Bch., on plum and all the Coccids of apple and pear. Other native species have adapted themselves to introduced plants, and ubiquitous species have in some instances adapted themselves to native ones. A chart shows the principal native or ubiquitous plants of the western Mediterranean basin and the extent to which each is attacked by specific, native polyphagous and ubiquitous Coccids.

Ahlberg (O.). **Ärttripsen** (*Kakothrips robustus* **Uzel**). [The Pea Thrips.] —*Medd. CentAnst. Försöksv. Jordbr.*, no. 406 Landbruksentom. Avd., no. 63, 11 pp., 8 figs. Stockholm, 1932.

Kakothrips pisivorus, Westw. (*robustus*, Uzel), all stages of which are described, is one of the most important pests of peas in Sweden, and its control presents the greatest difficulties. It was first observed in Sweden in 1899, and in 1912 it caused such serious damage that some crops were reduced to one-third and even to one-quarter of the normal. During the following years the losses involved were estimated at about 50 per cent.

The time at which the eggs are laid is largely dependent on weather conditions, but oviposition usually begins soon after midsummer. In favourable years it may occur earlier, or if the season is cold, be delayed until the middle of August. The eggs are laid preferably in the flowers. When the larvae are fully fed, they burrow in the earth to a depth of 8–12 inches to hibernate, but do not enter the pre-pupal stage, which

lasts only 3–4 days, until the following year. In order to study this stage, which was previously unknown, larvae that had been allowed to overwinter in a cylinder of clay buried in the soil were isolated in small glass tubes filled with earth and again buried to the correct depth. Development from pre-pupa to pupa was easily observed by removing these tubes each day.

The great difficulties experienced in controlling this thrips are due to its habits, almost the entire development taking place within the plant where it is well protected. In hot or sunny weather when the pods are developing, some larvae remain exposed on the free surface of the pods, where they could be killed by quassia or nicotine sprays, but these are comparatively few in relation to those in flowers, etc. As the flowers and buds of peas may be present simultaneously at all stages of development, to obtain anything like a satisfactory result, it is necessary to spray at least twice a week throughout the entire blossoming period, but tests have shown that the slight increase in crop obtained fails to justify the cost of labour and material. As there is no possibility of reaching the larvae in the soil with the technical means now available, it seems impossible to effect control by direct measures.

Experience has shown, however, that the thrips is always most numerous and causes most severe injury where peas are grown year after year on the same ground, and also that it thrives best in very light soil, probably because the full-grown larvae find it easier to penetrate to a convenient depth than in heavier soil. Peas should not, therefore, be grown two years in succession on the same ground, they should be sown as far as possible from any place in which they have been cultivated in the preceding year, and heavy soils should be chosen in preference to light ones. The pea plants should be cut down as soon as possible after harvest and either burned or used as green fodder.

THIEM (H.). **Die Bienenwolf-Plage im Kaligebiet der Werra und ihre Bekämpfung.** [The Outbreak of the Bee Pest, *Philanthus triangulum*, F., in the Potash District of the Werra Valley and its Control.]—*Deuts. Bienenz. Theorie & Praxis*, also in *Imker aus Thüringen*, 1932, no. 6, reprint 16 pp., 11 figs. Berlin, 1932.

In the summer of 1930 the Sphegid, *Philanthus triangulum*, F., destroyed very large numbers of honey-bees in a district in Germany in which its increase was due to dumps of potash salts and ash from lignite used as fuel, which provide material in which it can easily make its nests. It rears its brood in permanent galleries at various depths with an observed maximum of 15 inches. The manner in which the bees are captured and placed in the brood-chamber as food for the larvae is described. Experiments showed that control is possible by soil-fumigation carried out daily in July and August with a mixture of carbon bisulphide, paradichlorobenzene and tetrachlorethane.

HERMANS (B. J.). **Bestrijding van schadelijke keverlarven, regenwarmen en andere in den grond levende dieren in grasvelden.** [The Control of injurious Beetle Larvae, Earthworms and other Pests of Grass living in the Ground.]—*Tijdschr. Plantenziekt.*, xxxviii, no. 6, pp. 119–123, 7 refs. Wageningen, 1932.

Methods advocated in England and the United States against Coleopterous larvae and other soil-inhabiting pests of lawns, golf greens, etc., are surveyed, with some notes on experiments made in Holland.

[Piontkovskiĭ (Yu. A.).] **Пионтковский (Ю. А.). Data on the Biology and Ecology of the Cotton Mite,** *Tetranychus* (*Epitetranychus*) **sp.** [*In Russian.*]—8vo, 36 pp., 8 figs., 9 graphs, 23 refs. Moscow, Nauchno-issled. Inst. Khlopkov. [Sci. Res. Inst. Cott. Cult.], 1932. Price 80 *kop.*

A detailed account is given of the bionomics of the red spider that attacks cotton in Uzbekistan and Daghestan. The author considers the species concerned to be *Tetranychus* (*Epitetranychus*) *bimaculatus*, Harvey, which he regards as distinct from *T. telarius*, L. (*E. althaeae*, v. Hanst.). Some of the information has already been noticed [*R.A.E.*, A, xvi, 668]. The morphology of all stages is discussed in detail, with a list of the food-plants. The number of generations observed in the field during the period of the activity of the mite was 17 in Uzbekistan and a maximum of 12 in Daghestan, the life-cycle being completed in a period that varied from 5 days in July at an average temperature of 27·7°C. [81·86°F.] and relative humidity of 59 per cent., to 26 days in April at 15·8°C. [60·44°F.] and 66 per cent. The incubation period varied from 3 to 19 days. The larval stage averaged 47 hours and the nymphal 78·5, more than half of these periods being spent by the larvae and nymphs in a resting state when they suspend feeding. The maximum adult life of the females was 18 days and of the males 34. The number of eggs laid varied from 9 to 182. All the active stages are able to spin a web. Hibernation was observed in the adult stage only, the mites congregating in small groups on various weeds. The effect of temperature and relative humidity on the fertility of the mite is discussed at length; in Uzbekistan 56–65 per cent. humidity combined with a temperature higher than 25°C. [77°F.] affords optimum conditions for breeding.

Besides the control measures already noticed [*loc. cit.*], clean cultivation of cotton and the destruction of weeds is recommended for preventing infestation.

Hart (P. C.). **De topboorderaantasting der rijpheidsmonsterstokken in oogstjaar 1931.** [Tip-borer Infestation of Sugar-cane Ripeness Samples in the Crop-year 1931.]—*Arch. Suikerind. Ned.-Ind.*, 1932, no. 25, pp. 525–540; also as *Korte Meded. Proefst. Java-Suikerind.*, no. 8. Surabaya, 1932.

An account is given of the results of a survey of the infestation of sugar-cane in Java in 1931 by the tip-borer, *Scirpophaga intacta*, Sn., based on the examination of the canes brought in for sampling ripeness [*cf. R.A.E.*, A, xviii, 704]. Tables show the distribution of infestation in different localities. Hazelhoff's finding that high rainfall leads to increased attack [xix, 568] appears to be correct. The degree to which various varieties of cane are infested is also recorded.

Betrem (J. G.). **Witte Luis.** [Mealybugs.]—*Bergcultures*, vi, no. 22, pp. 552–562, 5 figs. Batavia, 1932.

The chief mealybugs infesting coffee in Java are *Ferrisiana* (*Ferrisia*) *virgata*, Ckll., *Pseudococcus citri*, Risso, and an unidentified species of *Pseudococcus*. Notes are given on the bionomics of the first two, largely from the literature [*R.A.E.*, A, xviii, 362, etc.]. *F. virgata* appears to spread to coffee from lamtoro [*Leucaena glauca*] and is best combated by scorching it off this shade-tree by means of a flame. *P. citri* may be controlled by spraying with a kerosene emulsion [xix, 574].

TEMPANY (H. A.). **Division of Entomology.**—*Ann. Rep. Dept. Agric. S.S. & F.M.S. 1931*, pp. 40–43. Kuala Lumpur, 1932.

Many of the pests observed in Malaya during 1931 have been noticed previously [*R.A.E.*, A, xix, 446, 646; xx, 11, 212]. Wet, mouldy copra appears to be preferred to the dry material by *Necrobia rufipes*, DeG. [xx, 399] and the Cucujid, *Cathartus* (*Silvanus*) *advena*, Waltl. The Coccid, *Aspidiotus destructor*, Sign., is frequently observed entirely covering the fruits of oil palm [*Elaeis guineënsis*], and although no perceptible decrease in size is apparent, it is possible that the acidity of the oil may be increased. A survey of the distribution and prevalence of stem-borers of rice in the north-west of Malaya showed *Diatraea auricilia*, Dudg., to be the most prevalent. From the fact that quantities of infested stems carried ripened ears, it appears that the damage was caused after the grain had formed. *Nezara viridula*, L., was observed in large numbers on the panicles, and white ears, frequently considered the result of damage by stem-borers, were numerous on healthy stems. *Cletus punctiger*, Dall., and *Sogata furcifera*, Horv., caused injury to rice, and the former appears to take the place of *Leptocorisa acuta*, Thnb., in some districts. The Bombyliid, *Hyperalonia* (*Exoprosopa*) *tantalus*, F., was discovered to be a parasite of species of *Campsomeris* attacking *Psilopholis grandis*, Cast. [xx, 398].

DOVER (C.). **Entomological Investigations on the Spike-disease of Sandal** (*Santalum album* **Linn.). Part I. An introductory Survey of the Problem.**—*Ind. For. Rec.*, xvii, pt. 1, 53 pp., 8 figs., 4 pp. refs. Calcutta, 1932. Price 1*s.* 9*d.*

This paper contains a brief summary of the history and characteristics of spike disease of sandal (*Santalum album*) in India, reviews the methods and results of a survey of its insect fauna, discusses the complex of factors involved in the interpretation of the data, and provides a critical approach to further studies on the possible transmission of the disease by insects. It is assumed, as a fundamental hypothesis, that spike disease is due to a virus and, as sucking insects are primarily concerned in the transmission of such diseases, a special section is devoted to the Rhynchota found on sandal. It is concluded that the disease can only be transmitted by a specific vector, or by a small group of closely related sucking insects [*R.A.E.*, A, xix, 651].

HUTSON (J. C.). **Some Insect Pests of Tea in Ceylon. The Red Slug** (*Heterusia cingala* **Moore**).—*Trop. Agriculturist*, lxxix, no. 1, pp. 3–18, 1 pl., 10 refs. Peradeniya, July 1932.

Notes are given on the bionomics and control of the Zygaenid, *Heterusia cingala*, Moore, on tea in Ceylon. Of 100 recorded outbreaks between 1900 and the end of 1925, 90 occurred at elevations of from 1,000 to 5,000 ft., 86 between July and February and 36 during August-October.

The following is largely taken from the author's summary: The eggs are laid at night on the tea bushes, either in cracks of the stems and branches or under mosses at the base of the stem. A single female may lay nearly 2,400 eggs, but the average for 12 moths was 1,177. Breeding experiments, together with previous records, indicate that the egg, larval and pupal stages last 7–10, 37–56 and 14–21 days, respectively, the males developing rather more rapidly than the females. At

first the larvae eat small patches from the leaves, but as they grow older they may almost strip the bushes. The cocoons are formed in folds of the older leaves on the tea bushes or neighbouring trees and also on fallen leaves. The fact that *H. cingala* is only periodically prevalent is probably chiefly due to parasitism of the larvae by the Tachinid, *Exorista heterusiae*, Coq. They are also attacked by the Braconid, *Apanteles heterusiae*, Wlkn., crows, which destroy large numbers during heavy infestations, and a wilt disease. Control measures include the collection of the larvae and cocoons; if necessary, all fallen leaves should be swept up and burnt.

Zeck (E. H.). **Investigations on two White Wax Scales** (*Ceroplastes*) **as Pests in Australia.**—*Agric. Gaz. N.S.W.*, xliii, pt. 8, pp. 611–616, 4 figs., 6 refs. Sydney, 1st August 1932.

A study of white wax scales in Australia has shown that the species that has been troublesome for many years on *Citrus* is the African *Ceroplastes destructor*, Newst., or possibly an allied species, and not the Indian *C. ceriferus*, And., as was generally supposed. The latter does, however, occur on a limited number of garden plants and native shrubs. Preliminary lists of food-plants of each species in New South Wales are given, with descriptions and figures illustrating and comparing the characters of the two Coccids in their various stages.

Evans (J. W.). **The Bionomics and economic Importance of** *Thrips imaginis*, **Bagnall, with special Reference to its Effect on Apple Production in Australia.**—*Pamph. Counc. Sci. Ind. Res. Australia*, no. 30, 48 pp., 3 pls., 13 figs., 33 refs. Melbourne, 1932.

Injurious outbreaks of thrips on apples in Australia have been recorded at intervals during the last 25 years; until 1928 the damage was thought to be due to *Thrips tabaci*, Lind., but in that year it was found that *T. imaginis*, Bagn., was the commonest species in both eastern and western Australia, though in Tasmania the dominant species seems to be *Isoneurothrips australis*, Bagn. The only record of *T. tabaci* attacking apple outside Australia is one from Chile that may be due to a misidentification [*R.A.E.*, A, ix, 423]. Bagnall's original description of *T. imaginis* is reproduced, with the characters separating it from *T. tabaci*.

The technique used in breeding *T. imaginis* in the laboratory is described, and tables show the length of the various stages when kept at different constant temperatures; at 25°C. [77°F.] the life-cycle is completed in 10 days, though a temperature of 30°C. [86°F.] retards development. On apple and pear, the eggs are deposited in every part of the blossoms, mostly in the stems and sepals, as many as 150 being found in a single pear-blossom stem, and they may also be embedded in leaves adjacent to flower clusters. The indications are that unfertilised females produce only males. In the field it seems that females greatly outnumber males during the spring but that subsequently the sexes are present in about equal numbers. The insects feed mostly on the petals, stamens and pistils; after these are withered, they collect inside the calyx cup and also feed on the adjacent young foliage, pupating in the soil. It is probable that over 20 thrips in one blossom produce harmful effects in warm weather. If there are more than 50, the blossom falls even if fertilisation has occurred. The damage

generally appears as pale brown areas on the petals and brown lesions on the stamens and styles, the infested flowers being small, with concave petals. Various orchard conditions and their correlation with thrips incidence are discussed, and a table shows the blossoming period and susceptibility to thrips attack of certain of the principal varieties of apple grown in Australia.

The habits of the thrips are regulated largely by temperature, relative humidity, light intensity and wind. On very hot days they fly in swarms and settle on any available blossom. *T. imaginis* has a large range of food-plants, and food is available to it throughout the year though comparatively scarce in the winter. Natural enemies have little effect, and outbreaks must therefore be due to particular conditions of weather during the preceding season. Records of conditions during a period of five years are correlated with the occurrence or absence of outbreaks. In the spring, temperature is the main factor governing the activity of thrips. They are most abundant during October and early November, but are present throughout the year, beginning to reproduce actively from mid-August. For the immature stages, relative humidity is probably more important ; in the laboratory pupae do not attain maturity if kept in dry soil. Unusually heavy autumn or winter rainfall, followed by a relatively dry spring, will result in an outbreak in October and early November. It seems probable also that the autumn flowering of *Eucalyptus calophylla* in Western Australia may encourage the increase of numbers in the autumn generations, as they breed freely in the blossoms. During the spring, many food-plants are available, particularly *Cryptostemma calendulaceum* (Cape weed) ; *Echium plantagineum* probably serves as a source of infestation in Western and South Australia.

I. australis does not require such high temperature for its development as does *T. imaginis* and has been found in abundance in Victoria in the flowers of *Eucalyptus globulus* on 9th August and in Tasmania in apple blossom during October. *T. tabaci,* which is an introduced insect, is not essentially a blossom species though it is found abundantly in flowers. It becomes active at higher temperatures than *T. imaginis* and has therefore a shorter period in the spring in which to increase its numbers, so that it is less likely to become a serious pest of apple blossom.

The work so far done does not permit of definite recommendations for control, but it is suggested that when the temperature is rising in October and an outbreak is expected, a repellent should be applied, and this should be followed by a contact insecticide on the first cool day after one on which the temperature had risen above about 77°F., since during cool periods the insects are to be found sheltering under petals and leaves. Spraying during the days of actual infestation may be impossible, owing to the danger of scorching the blossoms, though the use of dusts would avoid this difficulty. Tests with repellents in the insectary and on a small scale in the orchard are described, of which the best was lime-sulphur combined with an adhesive consisting of 1 oz. resin dissolved in 40 c.c. methylated spirit to which 16 c.c. ammonia is added to prevent subsequent precipitation of the resin. One part of this mixture is added to 20 parts of water to which are added 20 parts of lime-sulphur. This must be well mixed and shaken and should be made up shortly before use or kept well stoppered. Tests with various substances as attractants, including benzaldehyde, cinnamylaldehyde, anisaldehyde, citral and geraniol, were made without positive results.

Experience has shown that the sprays usually recommended for thrips, consisting of miscible white oil, nicotine sulphate and water, are ineffective against *T. imaginis* [*cf. R.A.E.*, A, xx, 375]. A proprietary pyrethrum spray gave satisfactory results, as did two proprietary dusts, one of nicotine-tar and the other of pyrethrum. Much of the damage resulting from attack by thrips could be avoided by inducing early flowering of susceptible late mid-season varieties so that they may escape the periods of maximum abundance; this might be done by spraying the trees with red oil in August, which will produce blossoms 10 to 14 days earlier than usual. Cape weed should be kept down as far as possible, and cover crops of field peas should be turned in early, as both these form breeding sites for thrips. Flower gardens probably form centres from which infestations frequently arise.

WARD (K. M.). **Some Insect Pests of Stone Fruits. Control Measures Recommended.**—*J. Dept. Agric. Vict.*, xxx, pt. 7, pp. 343–347, 4 figs. Melbourne, July 1932.

A brief and popular account is given of the bionomics and control of the following insect pests in orchards in Victoria: *Cydia molesta*, Busck, *Anuraphis persicae-niger*, Smith (black peach aphis) and *Myzus persicae*, Sulz. (green peach aphis), which infest peaches; *Caliroa (Eriocampa) limacina*, Retz. (pear and cherry slug), which feeds on cherry, plum, pear and hawthorn [*Crataegus*]; and *Nysius vinitor*, Bergr. (Rutherglen bug) which is polyphagous and causes particular injury to stone fruits ripening in December and January.

WEDDELL (J. A.). **The Banana Weevil Borer. Brief Notes on *Plaesius javanus* Er., the Histerid Predator.**—*Queensland Agric. J.*, xxxviii, pt. 1, pp. 24–29, 3 pls., 1 fldg. graph, 2 refs. Brisbane, 1st July 1932.

An account is given of investigations in Queensland on the biology of *Plaesius javanus*, Er., which attacks *Cosmopolites sordidus*, Germ. (banana weevil borer) in the half-rotting tissue of the pseudostem and the tunnelled and decaying corms of banana [*R.A.E.*, A, xix, 222]. Observations on small numbers indicate that the egg, larval, prepupal and pupal stages last about 8, 143, 33 and 48 days respectively. The adults are capable of strong flight and take wing readily in bright sunlight. This Histerid has not been found in sufficient numbers in the locality in which it was liberated to indicate any immediate possibility of its collection and distribution to other centres, and it is possible that conditions in the south of Queensland are unfavourable to the development of a large population or that a gradual increase in numbers is coinciding with a general spread not yet recorded.

NICHOLLS (H. M.). **The Woolly Aphis and its Parasite.**—*Tasmanian J. Agric.*, iii, no. 3, pp. 99–103, 3 figs. Tasmania, 1st August 1932.

The author discusses the country of origin of the woolly apple aphis [*Eriosoma lanigerum*, Hausm.], which he considers to be indigenous to America, owing to the natural occurrence there of its parasite, *Aphelinus mali*, Hald., and a hyperparasite. *A. mali* was introduced into Tasmania a few years ago [*R.A.E.*, A, xiv, 333], and in the drier and warmer northern part of the Island has multiplied to an extraordinary extent and spread considerable distances. Some evidence

has been obtained that it is distributed by winged Aphids in the first stage of parasitism. Its development from oviposition to the emergence of the adult occupies about 21 days, and its entire life-cycle about 30. There appear to be five generations during normal summers and more in warm, dry ones, the winter being passed within the host.

PAINE (R. W.) & SURRIDGE (H. R.). [Report of the] **Coconut Committee.** —*Ann. Bull. Div. Reps. Dept. Agric. Fiji 1931*, pp. 1–8. Suva, 1932.

Parasitism of *Tirathaba trichogramma*, Meyr., by *Apanteles tirathabae*, Wlkn., which was introduced into Fiji from Java in 1930 [*R.A.E.*, A, xviii, 617], reached a maximum of 62 per cent. in and around Suva by May 1931, but was less satisfactory on Taveuni, where the parasite has a greater area over which to spread. Establishment of the 1930 colonies was seriously influenced by the long drought, which reduced the output of coconut spathes and consequently also the number of available hosts. A small unidentified parasite was found infesting 15 per cent. of the cocoons of *A. tirathabae* in the breeding cage on Taveuni, but was not observed in the field. *Telenomus* sp., which attacks the eggs of *T. trichogramma*, and *Erycia basifulva*, Bezzi, which attacks the large larvae, were introduced from Java at the end of February. *Telenomus*, of which some 30,000 individuals were liberated during the year, was recovered in one locality in September, five months after its liberation there. Considerable difficulty was experienced in breeding *Erycia*, and the breeding stock died out on 24th June. By that time, however, colonies had been liberated on Taveuni and Vanualevu. An attempt made at the end of the year to recover this Tachinid on Tavenui proved unsuccessful. An indigenous Chalcidoid emerged from *T. trichogramma* in a breeding cage in November, and it was subsequently reared on the pupae. On one plantation this moth caused considerable damage to the first spathes bearing female flowers, and no set of fruit was recorded. However, as the result of the liberation of *Trichogramma* (*Trichogrammatoidea*) *nanum*, Zehnt., in August and *Apanteles tirathabae* in October, fruit set and new trees just bearing showed only isolated damage.

Aspidiotus destructor, Sign. (coconut scale) was found for the first time on Taveuni, where it had spread over a considerable area, but in view of the liberation of *Cryptognatha nodiceps*, Mshl., in July and its subsequent establishment, there is little likelihood of this scale becoming a serious menace [*cf.* xvii, 733]. A single small outbreak of *Levuana iridescens*, B.-B., was observed towards the end of the year, *Ptychomyia remota*, Aldr., exercising successful control elsewhere.

The unusual meteorological conditions during 1930 and the beginning of 1931 were probably responsible (owing to their effect on the natural enemies of the pests) for outbreaks of *Agonoxena argaula*, Meyr., and of *Promecotheca reichei*, Baly (coconut leaf-miner), which is now the most serious pest of coconuts in Fiji. Contrary to the general rule, an outbreak of the latter originated in an area of relatively high rainfall.

SIMMONDS (H. W.). **Annual Report of Government Entomologist, 1931.**—*Ann. Bull. Div. Reps. Dept. Agric. Fiji 1931*, pp. 9–12. Suva, 1932.

Records obtained in an experimental plot in Fiji indicate that migrations of *Cosmopolites sordidus*, Germ. (banana borer) occur on

warm, humid nights at certain seasons of the year, and that, contrary to the results of previous investigations, flight is a major factor in them. A large percentage of plants arising from suckers that have been immersed in water for the control of this pest [*R.A.E.*, A, xix, 686] have been found to be affected with bunchy top, indicating that the disease is present, but latent, in many of the banana clones of Fiji. Although this method of control has proved successful, experiments were carried out with an oil of chenopodium solution and a 1 per cent. sulphuric acid solution as other possible means of control; the results obtained were unsatisfactory. Pyrethrum powder is only partly effective against *Lamprosema* (*Nacoleia*) *octosema*, Meyr. (banana scab moth), as considerable damage is done before its application is possible. It was found that the eggs are normally only laid at the time the bunch is being shot, up to 400 having been collected from one plant, and the possibility of their destruction then is suggested.

Much damage was caused to *Citrus* by the fruit-piercing moth, *Othreis* (*Ophideres*) *fullonica*, L. In addition to *Dacus passiflorae*, Coq., an unidentified fruit-fly has been observed on several occasions on granadillas [*Passiflora*]. The fruits were successfully protected from damage by enclosing them in calico bags when half-grown. The seed capsules of tobacco were severely attacked by *Heliothis obsoleta*, F. Beet, silver beet and *Amarantus* sp. were badly infested by the larvae of the Pyralid, *Hymenia fascialis*, Cram., which, on Taveuni, were attacked by *Apanteles* sp.

The Tingid, *Teleonemia lantanae*, Dist., appeared to be of considerable value in the control of the noxious weeds, *Lantana crocea* and *L. camara*, during the dry weather in the latter half of 1930, but its numbers were greatly reduced by the heavy rain in 1931.

HARUKAWA (C.). **On the Life-history and Methods for the Control of *Acrocercops astaurota* Meyrick.** [*In Japanese.*]—*Agric. & Hortic.*, vii, no. 8, pp. 1407–1420, 1 pl. Tokyo, July 1932.

Descriptions are given of all stages of the Tineid, *Acrocercops astaurota*, Meyr., a pest of apple, pear, plum and other fruit trees in Japan. Much of the information on its bionomics is similar to that noticed elsewhere [*R.A.E.*, A, xix, 162]. The eggs do not develop at temperatures below 12°C. [53·6°F.] or above 30°C. [86°F.]. A nicotine spray is effective against the eggs, and pyrethrum extract combined with oil emulsion against the larvae.

SHIBUYA (S.) & YAMADA (S.). **On a new Pest of Arrow-head. Preliminary Report.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 3, pp. 112–115. Tokyo, July 1932.

An undetermined Tortricid is recorded as causing serious damage to arrow-head [*Sagittaria*] in Shizuoka, the larvae boring into the leaf stalks. There are at least two generations a year, hibernation taking place in the larval stage.

NAKAYAMA (S.). **On the Ecology, and especially the Moults, of *Trogoderma granarium* Everts.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 3, p. 150. Tokyo, July 1932.

The Dermestid, *Trogoderma granarium*, Everts, is found in Korea and Japan, where it feeds on stored rice and wheat. Near Suigen

it usually has one generation a year, the adults emerging in July and August. The egg, larval and pupal stages last 6–12, 317–351 and 6–17 days respectively.

KAMITO (S.). **On the Biological Control of Pests in the Countries along the Pacific Ocean.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 3, pp. 154–158. Tokyo, July 1932.

Aphelinus mali, Hald., and *Uscana semifumipennis*, Gir., an egg parasite of *Bruchus*, have been introduced into Japan from Oregon and Hawaii respectively, and are being bred. *Cryptolaemus montrouzieri*, Muls., was also imported from Hawaii, but the field temperatures seem to be too low for it, and *Trichogramma nanum*, Zehnt., introduced from Malaya, did not survive.

WATANABE (C.). **A Revision of Braconid Species parasitic in the injurious Insects of Rice-plant and Sugar-cane in Japan and Formosa.**—*Trans. Sapporo Nat. Hist. Soc.*, xii, pts. 2–3, pp. 63–72, 33 refs. Sapporo, 1932.

Notes are given on the synonymy, hosts and distribution of the following Braconids: *Shirakia schoenobii*, Vier. (*dorsalis*, Mats. [*R.A.E.*, A, v, 575; xiii, 467]), recorded from *Chilo simplex*, Butl., *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) and *Sesamia inferens*, Wlk., in Formosa; *Stenobracon trifasciatus*, Szép. (*S. maculata*, Mats., *Macrocentrus javanicus*, Ishida [v, 575; xiii, 467; xvii, 705]), from *Schoenobius bipunctifer* and *C. infuscatellus*, Sn., in Formosa, and *Scirpophaga nivella*, F., in Java; *Microbracon* (*Bracon*) *chinensis*, Szép., from *C. infuscatellus* and *Schoenobius bipunctifer* in Formosa, *Sesamia inferens* in Java and *Diatraea* sp. found in Italian millet (*Setaria italica*) in Korea; *M.* (*B.*) *onukii*, sp. n., and *Chelonus munakatae*, Munakata (*chilonis*, Cush. [xviii, 251]), both from *Chilo simplex* in Japan and *Diatraea* sp. in Italian millet in Korea; *Microgaster russata*, Hal., from *C. simplex* in Japan; *Apanteles flavipes*, Cam., from *C. simplex* in India, Formosa and Japan and *C. infuscatellus*, *Diatraea venosata*, Wlk., *Eucosma schistaceana*, Sn., *Cirphis* (*Leucania*) *loreyi*, Dup., and *Sesamia inferens* in Formosa; and *A. flavipes* f. *chilonis*, Munakata (*chilocida*, Vier. [vi, 236; xvii, 154]) from *Chilo simplex* in Japan.

The genus *Amyosoma*, Vier., with type *chinensis*, Szép. (*chilonis*, Vier. [xvii, 194]) is regarded as a subgenus of *Microbracon* (*Bracon*).

CARTER (W.). **Studies of Populations of** *Pseudococcus brevipes* **(Ckl.) occurring on Pineapple Plants.**—*Ecology*, xiii, no. 3, pp. 296–304, 4 diag., 5 refs. Brooklyn, N.Y., July 1932.

An account is given of observations in Hawaii on populations of *Pseudococcus brevipes*, Ckll., found on planting material of pineapple, the movement of the mealybugs into young plantings, and the status of these populations in fields up to twelve months old. *P. brevipes* becomes established on planting material while it is still attached to the mother plant, and persists and even sometimes reproduces on it while it is drying on the trimming ground, so that large colonies may be established in new fields with the plants. Most of these colonies disappear either because ants fail to establish themselves quickly

enough in the same areas, or owing to the work of predators, or to the re-planting process eliminating retarded or unhealthy plants. Occasional plants, however, remain infested.

Observations lead to the conclusion that grasses are an important source of infestation of fields contiguous to them. There is a decided preference for the most succulent growth available, and young plantings adjacent to older fields are infested even though mealybugs still continue to occur on the older plants, although this may be a reaction on the part of ants to a reduced secretion by those living on drying tissue. Mealybug colonies have been known to disappear from failing plants and are rarely found on plants in an advanced stage of wilt, so that young plantings made next to ratoon fields are infested rapidly. There are also indications that infestations are established more rapidly on young and succulent plants than on plants of the same age the growth of which is retarded, and that the principal factor in the movement of mealybugs from wild food-plants and older pineapple fields to contiguous new plantings is *Pheidole megacephala*, F., although several other ants have been recorded as attending mealybug colonies [*cf. R.A.E.*, A, xiv, 544].

Watson (J. R.) & Thompson (W. L.). **Pin Worm on Tomatoes.**—*Florida Ent.*, xvi, no. 1, p. 14. Gainesville, Fla., July 1932.

Phthorimaea (*Gnorimoschema*) *lycopersicella*, Busck (pin worm) was the cause of heavy losses to tomatos in one district of Florida during the spring. The injury to the fruit is described [*R.A.E.*, A, xix, 654]. The caterpillars became particularly abundant towards the close of the season and infested practically all the fruit left on the plants after the season was over.

Entomology.—*42nd Ann. Rep. Alabama Agric. Expt. Sta. 1930–31*, pp. 47–49. Auburn, Ala. [1931.] [Recd. September 1932.]

Of 13 materials in dust form tested by J. M. Robinson against the turnip webworm [*Hellula undalis*, F.], lead arsenate, calcium arsenate, barium fluosilicate, sodium fluosilicate and cryolite killed all the larvae; the others were practically valueless. Of eleven sprays tried, sodium arsenite killed the plants and the rest were useless.

L. L. English briefly reviews work with oil sprays against Coccids on *Citrus*. For timing the application of the sprays removable adhesive bands are placed on infested limbs to catch the emerging larvae; a fresh band is fitted at the same spot each week and the number of larvae on the old band recorded. In the case of the camphor scale [*Pseudaonidia duplex*, Ckll.] fumigation with calcium cyanide dust was more effective than one application of 2 per cent. oil emulsion; oil treatment followed by fumigation was more effective than fumigation alone. In experiments with emulsions containing gum, it was found that the amount of oil retained by the foliage is almost directly correlated with the oil concentration of the spray.

A study by F. S. Arant on the life-history of *Chalcodermus aeneus*, Boh. (cowpea curculio) showed that oviposition is continuous from mid-June to the beginning of October, which corresponds roughly with the fruiting period of the cowpeas. Many of the overwintered adults continued to oviposit throughout the season, and a single female

deposited 102 eggs between 24th June and 17th August. The life-cycle from egg to adult varied from 23 to 53 days, the average being 30·8. Approximately 13 days of an average life-cycle were spent within the cowpea and the remaining 18 days in the soil. Considerable difference was observed in the susceptibility of varieties. In cage tests with various insecticides, sodium fluosilicate, barium fluosilicate and lead arsenate dusted on cowpea foliage produced a high mortality among the adult weevils, though they were slow in action.

H. S. Swingle continued life-history studies of *Curculio caryae*, Horn (pecan weevil) [*R.A.E.*, A, xix, 554]. Oviposition began on 22nd August and was at its maximum during the second week in September, with an average of 11·3 eggs per female. Emergence of larvae began on 26th September and continued until the following spring. The infestation was approximately twice as heavy as in 1930, varieties of pecan in which the kernels of the nuts harden early being the most severely attacked. *Myiophasia aenea*, Wied. (*nigrifrons*, Towns.), *Sarcophaga sima*, Aldr., and *Winthemia rufopicta*, Big., were reared from the larvae, but the total parasitism by these Diptera was less than 2 per cent. The fungi, *Metarrhizium anisopliae* and *Beauveria* (*Sporotrichum*) *bassiana* also attack the larvae and may prove of value in their control.

Haegele (R. W.). **Field Studies of the Beet Leafhopper** *Eutettix tenellus* **Baker.**—*Bull. Idaho Agric. Expt. Sta.*, no. 182, 51 pp., 10 figs., 5 refs. Moscow, Ida., February 1932. [Recd. September 1932.]

A detailed account is given of ecological studies of *Eutettix tenella*, Bak. (beet leafhopper) in Idaho, conducted in co-operation with the United States Department of Agriculture [*cf. R.A.E.*, A, xix, 263].

The following is taken from the author's summary: Important breeding grounds of *E. tenella* have been found in the south-western part of the State, to the west and north-west of, and some distance from, the sugar-beet districts, which are in the south. Other important breeding grounds adjoin the sugar-beet districts. The environmental conditions for the leafhoppers are similar throughout these areas. The spring food-plants studied were *Sisymbrium* (*Norta*) *altissimum* and *Sophia parviflora*, and the summer food-plants were *Salsola pestifer*, *Atriplex rosea* and *Bassia hyssopifolia*. Only the females hibernate, passing the winter in the uncultivated desert areas. They oviposit on the spring food-plants, and the first generation develops on them. This generation completes its development during May-June, the second during July-August, and the third is either partly or wholly completed during the autumn. Beets are not necessary for the completion of the seasonal cycle of the insect, because of the nature of the food-plant sequence on the desert breeding grounds. The adults of the first generation migrate from the spring to the summer food-plants in the desert and to the beet fields throughout the irrigated districts to the east and south-east. The western limit of the source of the migration is not known, but there is a continuity of breeding grounds to the north-west of the beet fields and the prevailing winds are north-west. The leafhoppers are found in greatest abundance in environments with sparse food-plant growth, in which the temperatures are higher. Surveys from 1925 to 1929 showed no variation from year to year in the distribution of the leafhopper or of its food-plants, but there is a noticeable variation in its numbers.

Snyder (R. S.) & Magnuson (H. P.). **The Removal of arsenical Residue from Apples.**—*Bull. Idaho Agric. Expt. Sta.*, no. 187, 20 pp. Moscow, Ida., November 1931. [Recd. September 1932.]

The following is taken from the authors' summary: The use of $\frac{1}{3}$ per cent. hydrochloric acid in the washing solution is sufficient to reduce the arsenical residue below the ·01 grain tolerance on apples treated with sprays not containing any oils and washed immediately after picking. Solutions 2–4 times as strong may be used when oil or wax accumulations make the removal of residue more difficult, but concentrations of acid above two per cent. may cause injury to the fruit. The use of oil sprays in combination with lead arsenate has seriously complicated the problem. Oils with a viscosity higher than 65–75 cause considerable difficulty in the removal of the arsenical residue, as do even those of lower viscosity if used more than twice in the spray programme or if applied after 25th July. The removal is also difficult if the apples are placed in common storage or allowed to stand some time before being washed. Those placed at once in cold storage, however, are almost as easily washed as those treated immediately after picking. The addition of sodium chloride to the washing solutions sometimes assists in the removal of the residue, and at other times is of no value. Kerosene emulsion is very useful in dissolving wax and oil accumulations when used with hot hydrochloric acid solutions. When residue removal is difficult, heating the solution to 95–105°F. is much more effective than increasing its strength.

Wakeland (C.) & Rice (P. L.). **Codling Moth Life History in south-western Idaho.** –*Res. Bull. Idaho Agric. Expt. Sta.*, no. 10, 56 pp., 32 figs. Moscow, Ida., January 1932. [Recd. September 1932.]

In south-western Idaho, where the profitable production of apples depends on the degree of control of the codling moth [*Cydia pomonella*, L.], a three years' study, the details of which are recorded, has shown a marked variation in its activity in different years owing to varying climatic conditions. There are generally speaking two generations in a year, but a few of the first generation larvae overwinter, and there is annually a partial third generation, the numbers of which are dependent on seasonal conditions. Third-generation larvae seldom mature before harvest, but they cause many small punctures in the fruit. The spraying programme is considerably affected by the fact that every year some moths of the overwintered generation develop slowly and give rise to larvae that enter the apples at a time when it is unnecessary to spray for larvae that develop normally. The irregularity of seasonal development is further influenced by the fact that the length of the hibernating period of individual larvae varies greatly, the extremes determined being 165 and 325 days. A few were found to require more than a year to complete their life-cycle. The average numbers of eggs deposited by individual females during these studies were 57·17, 102·72 and 120·41 for the overwintered, first and second generations, respectively.

Blackman (M. W.). **The Black Hills Beetle** (*Dendroctonus ponderosae* **Hopk.**).—*Tech. Pub. New York St. Coll. For.*, no. 36, 97 pp., 5 figs., 1 fldg. graph, 10 pls., 15 refs. Syracuse, N.Y., November 1931. [Recd. September 1932.]

A detailed account, chiefly based on investigations in Arizona and Colorado in 1925–27, is given of the bionomics and control of

Dendroctonus ponderosae, Hopk. (Black Hills beetle) [*R.A.E.*, A, xiv, 423 ; xv, 428], which is the most serious pest of western yellow pine (*Pinus ponderosa*) in the central Rocky Mountain region.

The winter is passed beneath the bark of the tree as a larva or in some instances as an adult, but few of the overwintered adults continue to oviposit in the spring. The pupal period lasts from May to about the first week in July, but emergence does not usually begin till the last week in July and reaches its height during August. The adults migrate to living trees, in which they bore galleries of an average length of slightly more than 2 ft. When flying any considerable distance, they travel with the wind. On the penetration of the phloem, the tree exudes a more or less copious flow of resin, which if it is too great or the infestation too small, may kill the beetles or cause them to abandon their burrows. Thus a concerted attack by a number of beetles is necessary to kill a vigorous tree. An average of 184 eggs are laid singly in small niches in the sides of the egg gallery, which runs parallel to the grain on the surface of the sapwood. Oviposition continues, in some cases at least, until the cold weather stops all activities. Casual observation indicates that the eggs hatch in 7–10 days. The larvae bore in the phloem throughout their lives, and in about 30 days are in the final instar and have extended their tunnels 3–3½ ins. at right angles to the egg gallery. Despite the fact that not only lack of food but also other limiting factors are operative, the beetles may increase at the rate of 200–1,000 per cent. with each annual generation.

The degree of infestation to be expected in the following season may be predicted by a count of the adults and living brood in 10 sq. ft. or more of each of a considerable number of felled trees showing various characteristics and in various surroundings. If this is done early in July, a deduction of 20–40 per cent. is necessary in view of subsequent mortality ; if the average number of brood is 3–4 times that of the attacking adults, an increase in infestation is probable, whereas if the brood is only slightly predominant, it is a good indication that the attack is dying down.

Climatic factors, particularly moisture, are of importance in determining the brood survival. There is a direct correlation between survival and the moisture of the inner bark. This latter is influenced by the thickness of the bark, for in seasons of deficient moisture trees having thin bark dry out quickly, and also by the character of the crown, for in seasons of normal or slightly deficient soil moisture the trees with heavier crowns contain more moisture, whereas in seasons of pronounced deficiency those with smaller leaf surfaces contain the greater amount. A study of outbreaks of *D. ponderosae* in connection with data showing the average annual growth of normal trees indicates that past outbreaks developed during periods of rapid growth and, with one exception, terminated with a coinciding decrease in the rate of growth. Assuming that soil moisture is the most important factor influencing the annual growth of the tree, it would seem to follow that optimum conditions for the brood occur when more than the average amount of soil moisture is available to the infested tree. Established outbreaks are little affected by small annual variations, but a considerable increase or decrease of moisture for several years adversely affects the brood and results in a control of the outbreak. Trees situated in direct sunlight often develop subcortical temperatures that are lethal to the brood. This, however, may be prevented by the

cooling effects of currents of air, which, on the other hand, may be beneficial by accelerating evaporation from the bark surface and in seasons of deficient moisture may aid materially in the desiccation of the inner bark and thus increase the mortality.

The Clerids, *Enoclerus sphegeus*, F., and *Thanasimus nigriventris*, Lec., and the Trogositid, *Temnochila virescens* var. *chlorodia*, Mann., attack *D. ponderosae* to some extent, and certain Dipterous larvae, a Raphidiid and Anthocorids are other possible enemies, though none is of any great importance. The larvae of certain Longicorns, however, especially the Lamiid, *Acanthocinus spectabilis*, Lec., have an appreciable effect on the survival of the brood, by robbing the beetles of their food, by destroying them bodily and by loosening the bark and thus aiding in its desiccation. Others of minor importance are the Lamiids, *A. obliquus*, Lec., and *Monochamus maculosus*, Hald., and the Cerambycids, *Asemum atrum*, Eschz., and *Tetropium velutinum*, Lec. Two species of birds may, under certain circumstances, be fairly important in reducing the population. Trap trees (belt-girdled and hack-girdled) provided little or no attraction for the beetles, though felled trees when freshly prepared were attacked nearly as heavily as normal trees. In such trees the brood in all cases observed suffered a nearly complete mortality. The usual methods of control are recommended [viii, 490]. The early recognition and prompt treatment of incipient outbreaks, as shown by several cited instances, undoubtedly prevents the development of infestations that would otherwise become serious.

Brief notes are given on the following secondary or associated bark-beetles: *D. convexifrons*, Hopk., *D. approximatus*, Dietz, *Ips knausi*, Sw., *I. integer*, Eichh., *I. oregoni*, Eichh., and *Hylastes* (*Hylurgops*) *subcostulatus*, Mannh., all of which are attacked by *E. sphegeus*, and also *D. valens*, Lec., *D. barberi*, Hopk., *Ips* (*Orthotomicus*) *ornatus*, Sw., *I.* (*Pityogenes*) *carinulatus*, Lec., *Pityophthorus clarus*, Blkm., *P. grandis*, Blkm., *P. acutus*, Blkm., *P. caelator*, Blkm., *P. brevis*, Blkm., *P. tuberculatus*, Eichh., var. *australis*, Blkm., *Gnathotrichus denticulatus*, Blkm., and *G. aciculatus*, Blkm.

Jackson (T. P.). **Work connected with Insect and Fungus Pests and their Control.**—*Rep. Agric. Dept. St. Vincent 1931*, pp. 7–13. Trinidad, 1932.

Brief notes are given on the pests occurring in St. Vincent during 1931, few of which appear to have been of any outstanding importance. *Platyedra gossypiella*, Saund. (pink bollworm) first appeared 148 days after the planting of the cotton crop [*cf. R.A.E.*, A, xix, 657], and it seems to be now under good control. Outbreaks of *Calpodes ethlius*, Cram., occurred on arrowroot from June to August. On the part of the Island exposed to the north-east trade winds, the building of shelters covered with grass and the planting of windbreaks in the vicinity of arrowroot fields, etc., are recommended as providing suitable protection for its natural enemies, of which *Trichogramma minutum*, Riley, and *Polistes annularis*, L., are the most important. Considerable loss was caused to tomatos by *Gryllotalpa* sp. This mole-cricket remains in its burrow by day and feeds at night. Various control measures were adopted, none of which prevented large numbers of young plants from being cut down. Well-grown seedlings 8–9 ins. high should be planted, as they are not so attractive as less mature ones. The critical period of attack is the first 48 hours after planting, for the plants grow less

attractive as they become established. If possible the land should be planted on the day on which it has received cultivation, as this destroys the burrows of the insects, which take some time to regain their normal activity. For the protection of valuable plants one teaspoonful of carbon bisulphide poured into a hole a few inches deep adjacent to the seedling is recommended.

A summary of legislation in the Colony dealing with the importation of animals and plants and the control of cotton pests is appended.

[Tucker (R. W. E.).] **Entomological Section.**—*Agric. J. Dept. Sci. Agric. Barbados*, i, no. 2, pp. 24–25. [Bridgetown] April 1932.

The mass rearing and the liberation of *Trichogramma* [*minutum*, Riley] for the control of *Diatraea* [*saccharalis*, F.] in sugar-cane was continued in Barbados during the year 1931–32, and additional breeding stations have been established that will make possible the liberation of twice as many parasites for the growing season of 1932. *Lixophaga* [*diatraeae*, Towns.] introduced in 1930 for the control of this pest [*R.A.E.*, A, xix, 106, 627] has not yet been recovered. Evidence has been obtained of progress in the control of *Diaprepes* [*abbreviatus*, L.] by the co-operative hand-collection of the beetles and eggs. The egg parasite, *Tetrastichus* [*haitiensis*, Gahan], introduced from Haiti for its control [*cf.* xix, 720], failed to breed in Barbados, and the material from Porto Rico, though successfully reared and liberated, has not yet been recovered in the field. *Compsilura concinnata*, Mg., was introduced from America for the control of army worms, etc. [*cf. loc. cit.*], but only a few individuals survived the journey.

Cleare (L. D.). **Moth-borer Damage in Relation to Sugar-cane Varieties in British Guiana.**—*Trop. Agriculture*, ix, no. 9, pp. 264–271, 7 refs. Trinidad, September 1932.

An account is given of investigations carried out in British Guiana on the resistance of certain varieties of sugar-cane to attack by *Diatraea saccharalis*, F., and *D. canella*, Hmpsn.

The following is taken from the author's summary: Statistical examination of data obtained from two fields laid out according to modern experimental methods as variety trials shows that the degree of resistance differs markedly and that it may be a character of the particular variety and possibly capable of transmission. It appears that the extent of the damage is closely related to the percentage of sucrose in the cane, and also that different varieties are affected to varying degrees by similar amounts of injury.

Currie (G. A.) & Garthside (S.). **The Possibility of the Entomological Control of St. John's Wort in Australia. Progress Report.**—*Pamph. Counc. Sci. Ind. Res. Australia*, no. 29, 28 pp., 3 figs., 37 refs. Melbourne, 1932.

The problem of the control of St. John's wort (*Hypericum perforatum*) in Australia is discussed, and the researches undertaken in England and Australia leading to the introduction of *Chrysomela hyperici*, Forst., *C. brunsvicensis*, Grav.,* and *C. varians*, Schaller [*R.A.E.*, A, xv, 658; xix, 234] for this purpose are described.

In England, the eggs of *C. hyperici* are laid from September to February on the young under-shoots and do not hatch until the spring;

*We are informed by Mr. Garthside that this is the species previously recorded [xix, 234] as *C. didymata*, Scriba.—Ed.

the larvae pupate in early summer, and the adults emerge about July to feed voraciously for 1–2 months before commencing oviposition. At an average temperature of 64°F., the larval stage occupied an average of 26–27 days, the prepupal 10–11 and the pupal 12. The maximum number of eggs laid by a single female was 3,752. The biology of *C. brunsvicensis* seems to be somewhat similar, but a second generation during the summer appears probable. The larvae of *C. varians* were first found towards the end of May 1929. Chrysomelids were first shipped to Australia in September 1929, and by the following summer *C. varians* and *C. brunsvicensis* were well established in the insectaries at Canberra. Experience has shown that the beetles are most easily transported in cold storage as eggs or as adults that have been fed for a few weeks. The consignment of *C. hyperici* ultimately died out, but *C. varians* overwintered as an adult and was depositing large numbers of larvae by the end of September 1930. *C. brunsvicensis* continued to feed and oviposit slowly throughout the winter, relatively few individuals being present in the spring. All tests have proved that these Chrysomelids are unable to feed on plants other than those of the genus *Hypericum* and that they feed on *H. perforatum* in all stages of growth. Liberations were first effected in October 1930 and have been repeated subsequently. On re-inspection of the primary liberations in December and February survivors could still be found, but at present it is too early to predict the results of the project.

The Tortricid, *Lathronympha hypericana*, Hb., was common in France and England in the areas visited. Difficulty was experienced in discovering where the eggs were laid or the stage in which the winter was passed. Apparently larvae hatching from eggs laid in the summer feed for a short time in autumn and then descend to the roots, at a fork in which they hibernate in a small chamber. In spring they migrate to the surface and feed on the leaves, finally pupating at ground level. There appear to be three generations a year, the larvae feeding on the leaves, which they web together, the flower buds and flowers. After an unsuccessful attempt at transporting the pupae and eggs, the hibernating larvae were satisfactorily introduced, the consignment arriving at Canberra in January 1931. The resulting adults oviposited, and the larvae passed the winter in roots in the insectary.

Lists are given of the insect fauna of St. John's wort in Australia and Europe, the following having received further study in England: the Geometrids, *Anaitis efformata*, Guen., and *A. plagiata*, L.; the Cecidomyiids, *Geocrypta braueri*, Handl. (obtained from galls on the roots), *Dasyneura* sp. (probably *hyperici*, Bremi), *Zeuxidiplosis giardi*, Kieff. (*giardiana*, Kieff.), which prevents the production of seed and which is being prepared for export to Australia, and *Macrolabis marteli*, Kieff., which appears to be an inquiline in the galls caused by *Dasyneura* or *Zeuxidiplosis* on the shoots; *Depressaria hypericella*, Hb., which attacks the weed in much the same way as *L. hypericana*, with which it is often associated in the field; and *Aphis chloris*, Koch, which has been found for the first time in England and apparently feeds exclusively on *Hypericum*.

RICHARDSON (A.). **A few Notes on the Large Wood Wasp** (*Sirex gigas*). —*London Nat.*, 1931, p. 53. London, 1932.

The author records the emergence in July 1931 of seven adults of *Sirex gigas*, L., from a branch of a felled cedar (*Cedrus libani*), a tree

that does not appear to have been previously reported to be attacked by this species. The tree was felled in Middlesex in June 1928 and sawn up 6 months later.

AKERMAN (A.). **Vetemyggans härjmingar.** [Injuries by Wheat-flies.] —*Sverig. Utsädesfören Tidskr.*, xl, pp. 290–294, 1930. (Abstract in *Neuheiten Geb. PflSchutzes*, 1932, no. 1–2, pp. 22–23. Vienna, July 1932.)

Sitodiplosis mosellana, Géh. (*Diplosis aurantiaca*, Wagn.) and *Contarinia* (*Cecidomyia*) *tritici*, Kby., sometimes cause a loss of 75 per cent. of the wheat crop in Sweden. The heaviest infestation occurs in varieties that germinate during the flight-period, so that late wheat should be grown in southern Sweden. This cannot be done in other parts of the country as the harvest would be too much delayed.

CORPORAAL (J. B.). **Die Schädlichkeit des *Trichodes apiarius* L. Ein Sammelreferat. (9. Mitteilung über Cleriden.)** [The Harmfulness of *T. apiarius*. A collective Summary. (9th Communication on Clerid Beetles.)]—*Arch. Bienenk.*, xiii, no. 2, pp. 80–88. Neumünster in Holstein, 1932.

This is a summary of information ranging from Aristotle to the present day on the occurrence of the Clerid, *Trichodes apiarius*, L., in bee-hives and the nests of mason bees. Very little is actually known regarding this supposed pest of honey-bees.

BORCHERT (A.). **Untersuchungen über die Schädlichkeit einiger Unkraut- und Schädlingsbekämpfungsmittel für die Bienen.** [Investigations on the Harmfulness to Honey-bees of some Weed-killers and Insecticides.]—*Arch. Bienenk.*, xiii, no. 3, pp. 103–117, 12 refs. Neumünster in Holstein, 1932.

In laboratory tests zinc sulphate, iron sulphate, barium chloride, and mercury bichloride were found to be poisonous to bees, usually at strengths weaker than those commonly used. Sodium chlorate and potassium chlorate were apparently harmless. Zinc oxide and zinc carbonate had a repellent action, so that it was not possible to ascertain the lethal dose. In practice, however, there can be little danger to bees arising from the use of any of these materials, as they are subject to dilution by dew and rain and are not applied to blossoms.

WERTH (E.) & others. **Krankheiten und Beschädigungen der Kulturpflanzen im Jahre 1930.** [Diseases and Injuries of Cultivated Plants in 1930 in Germany.]—*Mitt. biol. Reichsanst. Land- u. Forstw.*, no. 44, 50 pp., 2 graphs, 38 maps. Berlin, June 1932.

Annotated lists are given of the insect pests recorded in Germany in 1930, divided according to the class of crop attacked.

BRAUN (K.). **Tätigkeitsbericht der Biologischen Reichsanstalt für Land- und Forstwirtschaft, Zweigstelle Stade . . . vom 1. April 1931 bis 31. März 1932.** [Report from 1st April 1931 to 31st March 1932 of the State Branch of the Imperial Biological Institute for Agriculture and Forestry.]—*Altländer Ztg.*, 1932, nos. 103, 111, 114, 116, 119, 123, 124, 127. Jork, 1932.

Psylla mali, Schm., did little harm on apples in the fruit-growing districts of the Lower Elbe, owing to increasingly widespread winter

spraying with fruit-tree carbolineum. Experiments in the summer of 1931 with pupae of the winter moth, *Cheimatobia brumata*, L., obtained from various localities showed that the different dates of adult emergence characterising these strains were not a direct consequence of meteorological factors in the localities concerned. It is probable that climatic conditions destroy all late-emerging adults in the northern regions and mountain districts where the moths regularly emerge early. It was found that oaks and ash trees, and probably also alders, are a dangerous source of infestation of neighbouring orchards by *C. brumata* unless banding is applied to them as well as to the fruit trees. Bands are a quick and effective means for controlling a severe infestation, but in normal circumstances a sufficient number of the eggs is destroyed by 10 per cent. carbolineum. This was not, however, effective against *Anthonomus pomorum*, L., or *Cydia pomonella*, L. *Xyleborus* (*Anisandrus*) *dispar*, F., bred in many trees killed by the frosts in the winter of 1928–29 and then infested fruit trees, many of which were killed by it.

Thiem (H.). **Pleiosozontie als Arterhaltungsprinzip.** [Variability in Methods of Reproduction as a Principle in the Conservation of a Species.]—*Jenaische Z. Naturw.*, lxvii, pp. 488–492, 4 refs. Jena, 1932.

Near Naumburg, Germany, the sexes of the Coccid, *Lecanium* (*Eulecanium*) *corni*, Bch., occur in very variable proportions, while the males decrease in abundance in the foothills of the Thüringer Wald and disappear at altitudes between 1,600 and 2,300 ft. The proportion of the sexes varied according to food-plants. The maintenance of the species depends chiefly on parthenogenesis, the varying proportion of the sexes representing a transition to the state of parthenogenetic reproduction already reached by *Lepidosaphes ulmi*, L.

Horn (W.). **Agnostische Gedanken über die Rolle der Mathematik in der Biologie.** [Agnostic Thoughts on the Rôle of Mathematics in Biology.]—*Anz. Schädlingsk.*, viii, no. 8, pp. 89–92. Berlin, August 1932.

This is a criticism of the possibility of using mathematical formulae in biological work in view of the complex nature of the factors affecting living organisms.

Schwerdtfeger (F.). **Zur Methodik von Raupenleimprüfungen.** [Methods for Tests of Banding Adhesives.]—*Anz. Schädlingsk.*, viii, no. 8, pp. 93–96, 3 figs., 7 refs. Berlin, August 1932.

An account is given of methods that proved satisfactory for testing commercial adhesives used for the control of the pine Lasiocampid [*Dendrolimus pini*, L.] during an outbreak in Brandenburg in the spring of 1932. As the temperature of bark warmed by the sun is often much higher than that of the air [*cf. R.A.E.*, A, xx, 49], the liability of an adhesive to run was tested by applying it in horizontal bands on a board held vertically in front of electric lamps placed at such a distance that the temperature of the surface of the board was 50°C. [122°F.] and measuring the distance that it had flowed down after an hour's exposure. The property possessed by some adhesives of smearing the legs and mouth-parts of larvae that travel over a band and thus

eventually killing them is a very important feature that is usually ignored. To test this, the material was spread in a strip on a board so as to enclose a rectangle in which larvae of *D. pini* were placed. They moved about actively at the room temperature of 20°C. [68°F.], and after an hour those that had crossed the band were placed on pine branches and their deaths noted over a period of a fortnight. This test also indicated the quality of the fresh adhesive. Other banded boards, exposed for 4 weeks in a heated room and to weather out of doors, were used to show its lasting quality.

Janisch (E.). **Ueber die Eignung der Seidenraupe als Standardtier.** [On the Suitability of the Silkworm as a Test Insect.]—*Anz. Schädlingsk.*, viii, no. 8, pp. 96–99, 5 graphs. Berlin, August 1932.

The author describes various experiments in breeding silkworms [*Bombyx mori*, L.] to show how their vitality is affected by different conditions and to indicate data for obtaining standard cultures for tests of insecticides, etc.

Isoldi (R.). **La lotta contro le cavallette nel Vallo di Diano.** [Work against Locusts in the Vallo di Diano Area.]—*Il Picentino*, lxxxviii, no. 7, pp. 230–234. Salerno, July 1932.

About mid-June 1932 numerous centres of infestation by young larvae of *Calliptamus italicus*, L., were found in the province of Salerno, where the first larvae usually reach the adult stage at the end of July, oviposition then following in uncultivated or unploughed land such as fields of lucerne. The infestation was successfully controlled by spraying the young hoppers with crude oil.

Levy (J.). **La cloropicrina per la distruzione dei parassiti nei semi di cotone.**—*Boll. Reparto Fibre tessili R. Staz. sperim. Ind. Carta e Stud. Fibre tessili veg.*, iii, no. 2, pp. 102–105, 1 fig. Milan, August 1931. [Recd. September 1932.]

This is a translation from the French of a paper by the author describing an apparatus for fumigating cottonseed against insects, etc. The whole equipment is mounted on a cart and consists of a fumigation chamber, insulated to prevent loss of heat and having a valve to admit chloropicrin from an outside container, a motor-driven suction fan, and a lamp for heating the interior of the chamber to 40–45°C. [104–113°F.] so as to shorten the time required for fumigation. The chamber contains gratings on which the seed is spread. The hot air, charged with chloropicrin vapour, is sucked from the bottom of the chamber and blown into the upper part, the current being broken up by several gratings. At the end of the operation the air is extracted from the chamber by means of the fan, which discharges it to some distance.

[Vukasović (P.).] **Вукасовић (П.). Contribution to the Study of the Corn Borer (*Pyrausta nubilalis* Hübn.) in our Country.** [*In Serbian.*]—*Glasnik. Tzentr. Khig. Zavoda*, vii (xiii), no. 4–6, pp. 1–41, 2 graphs. Belgrade, 1932. (With a Summary in French.)

As the result of observations made in the maize-growing area in northern Jugoslavia in August and September of 1930 and 1931, a

detailed account is given of the infestation of this crop by *Pyrausta nubilalis*, Hb. The general condition of the maize was very poor in 1930, probably owing to severe drought, but was considerably better in 1931. The percentage of infested plants averaged 6·39 in 1930 and 15·6 in 1931. The degree of infestation was higher in maize sown early or grown in damp soil, and was also higher whenever the general condition of the maize was good, which indicates that the insect is favoured by the same optimum as the food-plant. The average number of larvae found per plant was 1·85 in 1930 and 2·19 in 1931, including the dead and parasitised individuals. Only 2·72–3·57 per cent. of the larvae occurred near the root in the stubble that remains in the field after the harvest. The most prevalent parasite was *Microbracon brevicornis*, Wesm., which destroyed an average of 5·68 per cent. of the larvae in 1930 and 8·58 per cent. in 1931, those occurring in the upper part of the plant being the most frequently attacked. This Braconid became most active at the end of the growing period of maize when the host larvae were full-grown. Parasitism by the Tachinid, *Ceromasia* (*Masicera*) *senilis*, Mg., averaged 2·2 per cent. in 1930 and 3·9 per cent. in 1931, and the Ichneumonid, *Eulimneria* (*Limnerium*) sp., was very rare.

On the whole, the infestation of maize in northern Jugoslavia by *P. nubilalis* in these two years was slight ; the robust variety " dent de cheval " cultivated in the area matured fully and showed little injury even when infested. Breaking of the stalks, which is the most serious form of injury, occurred comparatively seldom, being common only after storms, when the damage to healthy stems was equally great.

Report of the Activities of the Central Hygienic Institute and Organisations dependent on it in 1931. Department of Parasitology. [*In Serbian.*]—*Socijalno-Med. Pregled*, iii, no. 3–4, pp. 59–71. Belgrade, 1932.

A section of this report (pp. 61–62) briefly reviews the work on insect pests in Jugoslavia in 1931. In the course of studies on pests of stored products, it was found that the larvae and adults of *Tenebroides* (*Trogosita*) *mauritanicus*, L., feed with equal readiness on grain and on insect pests that occur in it, instances of cannibalism being observed among the larvae. Observations were also made on *Pyrausta nubilalis*, Hb., on maize, the Chrysomelid, *Phytodecta fornicata*, Brügg., on lucerne, and several pests of apples, of which *Cydia* (*Carpocapsa*) *pomonella*, L., was the most widely distributed and important, others including *Scolytus* (*Eccoptogaster*) *rugulosus*, Ratz., *S.* (*E.*) *mali*, Bechst., *Hyponomeuta malinellus*, Zell., *Lepidosaphes ulmi*, L., *Cossus* sp., *Zeuzera pyrina*, L., *Agrilus* sp., and *Eriosoma lanigerum*, Hausm.

[Belyaev (I. M.), Shesterikova (M. N.) & Popov (P. V.).] **Беляев (И. М.), Шестерикова (М. Н.) и Попов (П. В.). Materialen zur Forschung der Oelsamen Schädlinge bei Aufbewahren.** [Materials for the Study of Pests of stored Oil Seed.] [*In Russian.*]—*Schr. zent. biochem. ForschInst. Nahrungs-u Genussmittelind.*, i, no. 8, pp. 344–432, 47 figs., 1 graph, 25 refs. Moscow, 1932. (With Summaries in German.)

This work is divided into three sections, of which the first, by Belyaev, entitled " Pests occurring in Storehouses of oil-producing

Factories during the Storage of Oil Seeds " (pp. 344–393), gives the results of examination of samples of seeds, husks and sweepings from the floor taken in 65 storehouses in various parts of the Russian Union. The methods used throughout the work are described. Various Arthropods, a list of which is given, were found in 64 per cent. of the samples. Of these, 12 species were the usual pests of stored products, 8 were predatory, and 6 mycophagous. The remaining 16 species were usually found dead and were of doubtful relation to stored seed or had been introduced accidentally from the fields. The depth at which the pests occurred in the seed varied with conditions of humidity, temperature, etc., but mites were usually found at a depth of 8–16 ins., and beetles at 40–80 ins. The chief pests were the mites, *Tyroglyphus farinae*, DeG., and *T.* (*Tyrophagus*) *dimidiatus*, Herm., the beetles, *Tribolium navale*, F., *Silvanus surinamensis*, L., and *Laemophloeus ferrugineus*, Steph., and the moth, *Ephestia elutella*, Hb. Under laboratory conditions at 18–21°C. [64·4–69·8°F.] the adults of *T. navale* lived over 7 months and could withstand starvation for 25–41 days. Both adults and larvae were able to bite through the husks of sound sunflower seeds, but neither could penetrate into flax seed unless it was damaged, or survive at all in seeds of castor [*Ricinus communis*]. The adults of *L. ferrugineus* lived about 8 months, the life-cycle being completed in 36–75 days ; at 23–26°C. [73·4–78·8°F.] they withstood starvation for 3–5 days. The beetles attacked broken seeds only, sunflower being much preferred to flax. *E. elutella* occurred exclusively in sunflower seed. The maximum number of eggs laid by a female in the laboratory at about 30°C. [86°F.] was 261 ; at 25–28°C. [77–82·4°F.] the eggs hatched in 3·5 days. With a few exceptions, young larvae were unable to penetrate into undamaged seeds.

It was found that infestation is much less severe in well constructed storehouses kept free from heaps of sweepings, débris and scattered seeds. It is favoured by the increase of humidity and temperature that develops in stored seed.

The second section, by Shesterikova, is entitled " The Mites that occur in oil-producing Seeds, their Biology and the Injuries caused by them " (pp. 394–416), and deals chiefly with *Tyroglyphus farinae*, *T. dimidiatus* and *T. mycophagus*, Megn., which were the most common and injurious of the mites found. Much of the information given on their biology is taken from the literature. The hypopial form, which was usually mobile [*cf. R.A.E.*, A, xii, 104], appeared when they were fed on decayed seeds with a moisture content of about 50 per cent. ; if placed on sound material with a moisture content of 18 per cent., the hypopi transformed into adults within 4–8 days. In general the mites did not survive in material with a moisture content as low as 8 per cent. The optimum conditions for the development of *T. farinae* and *T. dimidiatus* was 18–24 per cent. moisture at 18–22°C. [64·4–71·6°F.], when the eggs hatched in 4–5 days, as compared with 11–12 days at 8–10°C. [46·4–50°F.]. The damage caused to the seeds of sunflower, flax, hemp and soy-bean and to sunflower-seed cake is discussed at some length. At a moisture of 12·5 per cent. and a temperature of 18–22°C. the mites did not attack the kernels of sound sunflower seeds, but slightly damaged the husk, which is more hydroscopic and so had a moisture of 14 per cent. Sound seed was attacked when the moisture was not less than 15 per cent., broken seed at 13 per cent. and sunflower-seed cake at 11. The presence of the mites tended to cause the moisture content of seed to rise somewhat.

Another mite, *Cheyletus eruditus*, Schr., was predacious on the Tyroglyphids, and in the laboratory each individual destroyed 6–10 adults a day and a number of eggs. It did not, however, occur in sufficient numbers in the storehouses to control them, as it does not increase so rapidly.

The third section, "Short Keys for the Determination of Insects, their Larvae and Arachnoids occurring in stored oil-producing Seeds" (pp. 417–422), is by Popov and is described as being preliminary in character. It is followed by an appendix (pp. 424–432) in which recommendations are made for such measures as the improvement of the conditions under which seeds are stored, fumigation, etc.

[Tibilova (—).] **Тибилова (—). Contribution to the Biology of the Spider Mite in the Tashkent Region.** [*In Russian.*]—*Byull. nauchno-issled. Inst. Khlopkovod.* (*NIHI*) [*Bull. Sci. Res. Inst. Cott. Cult.*], no. 1, pp. 49–61. Moscow, January 1932.

Observations in northern Uzbekistan in 1930 on the red spider attacking cotton, which may be *Tetranychus telarius*, L. (*althaeae*, v. Hanst.) or an allied species [*cf. R.A.E.*, A, xx, 576, 599, etc.], showed that there are probably ten generations during the season of activity, which lasts from the first half of March till the beginning of October. The average incubation period varied from 4·8 days in July to 20 in October at 15·5°C. [59·9°F.], but in April at a very little higher temperature (16·4°C. [61·52°F.]) it was only 8 days, which indicates that the development of the embryo partly depends on some factor other than temperature. In 4–5 hours after hatching, the larvae begin to spin a very fine web. In summer the duration of the larval stage did not exceed 2 days, including the resting period. The nymphal stage lasted 2 days in June, 3 in July and August, 4 in April, May and September, and 28 in October. The deutonymph stage, which is passed by females only, lasted 2 days in June-August, 2½ in May, 8 in April and 9 in September. Pairing takes place immediately after the deutonymph moults. The average period for oviposition was 25 days, with a maximum of 50, the bulk of the eggs being laid in June-August. The maximum number of eggs deposited by a female was 217. Unfertilised females laid eggs, which gave rise to males only.

A list of the food-plants of this mite is given. Experimentally, it showed no preference for smooth or hairy leaves or for cotton as compared with other plants. Migration to cotton, which usually starts in June, is probably due to the drying up of the weeds or to the crowded condition of the mites. Infestation may be spread by their being transported on agricultural implements or carried by wind or by water during heavy rains. In tests in which overwintered mites were submerged in water for varying periods, 67 per cent. survived for 20 hours and 22 per cent. for 78, 100 per cent. mortality only occurring after submergence for 100 hours. The summer generations proved to be more susceptible, 80 per cent. of the mites being killed after 9 hours and all after 10. It was also found that the mites may keep on the surface of the water for 24 hours.

The adults begin to enter hibernation in the first half of September. No immature stages were found hibernating, with the exception of one batch of eggs on a dry leaf. Hibernation occurs under lumps of earth, dry leaves and stalks lying on the ground, or on weeds that remain

green during the winter. No mites were present on cotton in the autumn after harvest. Apparently severe cold does not affect the mites ; of those that hibernated in unsheltered places exposed to a frost of about —28°C. [—18·4°F.], 95 per cent. survived.

Virus Diseases of Tobacco in Nyasaland.—*Bull. Dept. Agric. Nyasaland*, N.S., no. 2, 15 pp. Zomba, May 1932. [Recd. September 1932.]

One of the three diseases of tobacco discussed is that known as frenching or cabbaging, which Dr. H. H. Storey considers to be identical with leaf-curl as observed in Southern Rhodesia. His report on the latter [*R.A.E.*, A, xx, 330] is reproduced. Experiments by Dr. Arnold have definitely shown that the disease is transmitted by an Aleurodid in Nyasaland.

Priesner (H.) & Hosny (M.). **Contributions to a Knowledge of the White Flies (Aleurodidae) of Egypt (I).**—*Bull. Min. Agric. Egypt*, no. 121, 8 pp., 6 pls., 1 ref. Cairo, 1932.

Siphoninus granati, sp. n., all stages of which are described, is widely distributed in Egypt and may occur wherever pomegranates are grown when the microclimate is favourable ; this tree appears to be the only food-plant. Humidity is an important factor influencing the occurrence of this Aleurodid, which is numerous only in shady and humid localities. In cases of severe attack, the leaves curl under, turn yellow and may fall prematurely ; as a rule, however, the injury appears to be slight. Infestation is generally confined to the lower surface of the leaves and is characterised by whitish, circular spots caused by the ovipositing females. The winter is apparently passed as an adult. The immature stages were first observed in August, and the insect is numerous throughout the autumn. There are apparently 2–3 generations annually, infestation ending with the annual shedding of the leaves.

S. granati is heavily parasitised by *Encarsia partenopea*, Masi, which is briefly described as it is new to Egypt. This Aphelinid emerges from the pupal cases in great numbers from about the middle of August to the middle of December, and the degree of parasitism may reach 80 per cent. or more. The Trichogrammatid, *Neocentrobia hirticornis*, Bl. & Kr., was reared from infested twigs, but it is considered to have no connection with the Aleurodid. Should control measures become necessary, an oil emulsion could be used.

Bagnall (R. S.) & Cameron (W. P. L.). **Descriptions of two Species of *Hercothrips* injurious to Cotton in the British Sudan, and of an allied Species on Grass.**—*Ann. Mag. Nat. Hist.*, (10) x, no. 58, pp. 412–419. London, October 1932.

In researches on the cotton pests of the Sudan during the past few years two of the species now described have been recorded under the name of *Hercothrips* (*Heliothrips*) *indicus*, Bagn., though neither is in fact referable to it. Descriptions are given of both sexes of the adults and larvae of these two species (*H. fumipennis*, sp. n., and *H. sudanensis*, sp. n.) and of a third (*H. graminicola*, sp. n., which is restricted to grasses), with a key to them and to *H. indicus*.

H. fumipennis (dark cotton-leaf thrips) is probably distributed throughout the northern Sudan. In the Gezira it attacks cotton during the first half of the growing season only, often doing very severe damage. It attacks American cotton (Kassala Province) as well as Egyptian cotton (Gezira, Blue Nile Province and Kassala Province) annually, and occurs on *Dolichos lablab*, most varieties of beans and many other plants. *H. sudanensis* (grey cotton-leaf thrips) is generally distributed throughout the northern Sudan. In the Gezira cotton is chiefly attacked during the latter half of the growing season, the outbreaks being more spasmodic than those of *H. fumipennis*, though when they occur the damage is severe; *Leucas urticifolia* is very attractive to this thrips, but *Dolichos* and beans are less so than to *H. fumipennis*. *H. graminicola* is widely distributed in the Gezira, and probably elsewhere in the Sudan. It is only found just after the rains and attacks *Sorghum* spp. and other grasses.

CAMERON (W. P. L.). **Thrips affecting the Cotton Crop in Gezira in 1930.**—*Bull. Wellcome Trop. Res. Lab. Sudan Govt.*, Ent. Sect., no. 34, pp. 32–37. Khartoum, January 1931. [Publ. 1932.]

A preliminary account is given of observations during 1930 on thrips attacking cotton in the Gezira area. A variation in the colouring of the larvae led to the discovery that in addition to a species [*Hercothrips sudanensis*, Bagn. & Cam. (see preceding abstract)] here recorded as *H.* (*Heliothrips*) *indicus*, Bagn., which had previously been thought to be the only one affecting the yield of the crop, another [*H. fumipennis*, Bagn. & Cam.] was associated with it on the leaves. The characters differentiating it are discussed. A third species [*H. graminicola*, Bagn. & Cam.] apparently confined itself to *Sorghum* and other grasses. At least two undetermined species of another genus of thrips, which are recorded for the first time as pests of cotton in the Sudan, have been observed in the young buds, and it is thought that one of them causes curling and malformation of the leaves. Later-sown plants are severely attacked, their growth being completely retarded during the dry hot weather following the rains. The advent of the cold weather, however, checks the activities of these two pests, and the plants are able to outgrow the injury. These thrips have also been observed causing similar damage to mango, *Leucas urticifolia*, *Ocimum basilicum* and *Ipomoea* spp.

Species of *Hercothrips* were not much in evidence during the first half of the year, occurring chiefly on weeds and lucerne, though *H. sudanensis* was fairly abundant on cotton and increased slightly during April and May. On the arrival of the rains their numbers decreased considerably until about the end of July, observations indicating that thrips of this type rest as either adults or pupae in the soil during the summer. Subsequently they became increasingly abundant on weeds, and *H. fumipennis* migrated in large numbers to cotton and *Dolichos lablab*. During the first week in October infestation on cotton had become so severe that control measures had to be resorted to, and it was decided to reduce the interval of 15–17 days between waterings to 10 days. This proved effective, and *Hercothrips* was scarce on cotton until the last week in December, when *H. sudanensis* was the commoner species.

Cameron (W. P. L.). *Heliothrips* **sp. affecting the Rain-grown American Cotton at Galaa el Nahl, Kassala Province.**—*Bull. Wellcome Trop. Res. Lab. Sudan Govt.*, Ent. Sect., no. 34, pp. 37–39. Khartoum, January 1931. [Publ. 1932.]

An account is given of experiments in the Sudan during 1930 on the effect of the date of sowing cotton on the degree of infestation by *Hercothrips* (*Heliothrips*) [*fumipennis*, Bagn. & Cam.], which during recent years has become one of the most serious pests of the crop in southern Kassala. The results indicate that if the cultivation of American cotton under rain conditions in this area is desired, the crop must be sown as early in the rainy season as possible, the most suitable period in most years being during the last week in June or the first half of July. Sowing should be discontinued after mid-July since the resulting crops are poor and act as centres from which infestation spreads to those sown earlier.

Bedford (H. W.). **The Weed "Hambuk"** (*Abutilon* **spp.**) **and the Part it plays in the Conservation of Parasites of the various Species of Bollworm which attack Cotton in the Sudan.**—*Bull. Wellcome Trop. Res. Lab. Sudan Govt.*, Ent. Sect., no. 34, pp. 39–43. Khartoum, January 1931. [Publ. 1932.]

Brief reference is made to an account of investigations in the Sudan on the relationships of pests of cotton and their parasites to weeds of the genus *Abutilon* [*R.A.E.*, A, xix, 391]. They are not attacked by *Platyedra gossypiella*, Saund., records of which from them [*cf.* vi, 48] are apparently due to misidentification, but as they are preferred food-plants of *Earias insulana*, Boisd., their destruction in the dead season for cotton has been regarded as desirable. If this were done, the weeds should still be encouraged to flower and fruit during the cotton season, as they will then attract most of the moths in preference to the cotton. Their destruction even in the dead season, however, would be attended by a great disadvantage in that they serve throughout the year as food-plants of *Crocidosema plebeiana*, Zell. This moth is an alternative host of *Microbracon kirkpatricki*, Wlkn., which is the most effective of the parasites of *P. gossypiella*. Observations in 1930 showed that *Crocidosema* is least abundant during April-June, a period that approximately coincides with the dead season and in which the weeds flower and fruit little, particularly if deprived of irrigation water, but there is strong indication that as soon as the rainy season starts, both host and parasite increase in numbers, the latter, however, obtaining and maintaining the upper hand. It is very active on *Abutilon* from July for at least four months, a period in which the beginning of infestation of cotton by *Platyedra* occurs. To obtain early parasitism of the latter, an experiment is planned in which it is proposed to grow *Abutilon* during the dead season along the main irrigation canals bordering fields reserved for cotton. It is hoped that this will also favour the increase of various parasites of *Earias insulana* [xix, 391].

King (H. H.). **An Account of the Locust Campaign of 1930.**—*Bull. Wellcome Trop. Res. Lab. Sudan Govt.*, Ent. Sect., no. 34, pp. 7–22. Khartoum, January 1931. [Publ. 1932.]

During May-July 1930, the Sudan was invaded by *Schistocerca gregaria*, Forsk., swarms coming from the east into Kassala Province

and from the west into Darfur, while a few may have reached Kordofan from the north-north-west. They began to oviposit in July and continued until the second half of September. In July very large swarms of *Locusta migratoria migratorioides*, Rch. & Frm., entered Darfur from French Equatorial Africa; there were also unconfirmed reports of swarms of this species from Upper Nile Province, and of others having entered Fung Province from Abyssinia. Breeding began in July and continued in the Upper Nile, Mongalla and Bahr el Ghazal Provinces until the end of the year. *Schistocerca* prefers to oviposit in light sandy soils, which are not often found in the Sudan south of 13°N. Lat., and *Locusta* in heavier soils such as occur further south, so that the two species bred together only in a relatively narrow belt running from west to east across the country.

The standard method of control was that of sun-dried poison bran bait [*R.A.E.*, A, xvii, 507]. For its preparation, 1,100 tons of bran, 20 tons of sodium arsenite and 13,200 gallons of treacle were used, and a special concrete drying floor with an area of 4,784 sq. yds. was constructed, with tanks for sodium arsenite solution and treacle. Some 150 natives were employed daily for three months, and the dry bait in sacks was distributed to bait centres in the infested Provinces. The total amount of dry bait used during the campaign was 629 tons, corresponding to 1,527 tons of moist bait, and the results were reported as most satisfactory. The total cost of the campaign, including the construction of the drying floor, etc., was about £50,000.

King (H. H.). **Report of the Government Entomologist for the Year 1931.**—*Bull. Wellcome Trop. Res. Lab. Sudan Govt.*, Ent. Sect., no. 35, 12 pp. multigraph. Khartoum, January 1932. [Recd. August 1932.]

In 1931, apart from a few isolated instances, the Sudan remained practically free from invasions by *Schistocerca gregaria*, Forsk., until June, when a number of swarms entered the country; further invasions occurred in July and the first half of August. The total numbers of this locust that bred in the country was small as compared with the previous season [see preceding paper] probably owing to the success of the 1930 campaign and unfavourable weather conditions in the winter breeding grounds. *Locusta migratoria migratorioides*, Rch. & Frm., continued to breed throughout the year, and between June and October did so over an area extending as far north as parallel 20. The control measures employed against these locusts and the damage they caused are discussed.

J. W. Cowland reports that in the Gezira *Bemisia gossypiperda*, Misra & Lamba, which is the only known vector of "leaf-curl" of cotton [*cf. R.A.E.*, A, xix, 708], develops in 18–30 days, and the adults may live for 2–3 weeks or, under optimum conditions, for as long as a month. During the dead season or early summer and early rains this Aleurodid breeds in gardens and on plants growing under irrigation by the river. After the rains have broken, usually about the middle of August, it appears throughout the district, first on weeds and later on cotton, and soon becomes abundant. It prefers to feed and breed on the youngest leaves of healthy plants, and if an infested plant stops active growth, the insects on reaching maturity tend to migrate in search of fresh foliage. During the cool weather they descend to the sheltered

leaves and weeds near the ground, and throughout the winter gradually decrease in numbers until by March and April hardly any are to be found on cotton land. No indication of a resting stage has been observed. In addition the immature stages are heavily attacked during this period by parasites and predators, with the result that the insect is almost exterminated. In its absence, the natural enemies are in turn considerably reduced in numbers, and consequently with the beginning of the rains the whitefly is able to multiply and spread.

In a large number of transmission experiments, in which *B. gossypiperda* was used as a vector, neither *Abutilon glaucum* nor any plant outside the family Malvaceae proved susceptible to infection in either a visible or transmissible form. A prevalent disease of tomatos was found to be due to a virus that is transmitted from tomato to tomato by this Aleurodid. Symptoms of this disease, however, failed to develop on either cotton or tobacco, when the whiteflies were transferred to these plants from infected tomato.

In an attempt to prevent a recurrence of the severe outbreak of leaf-curl of the previous season, when 90 per cent. of the plants developed the disease, instead of growing cotton in rotation with other crops, it was decided to grow cotton alone, followed by two years of fallow. By this means it was hoped to facilitate the destruction of any ratoon cotton, which is probably the chief source of infection. As a result, there were decidedly fewer original centres of infection in the 1931 crop, and although some of the surrounding plants developed symptoms of the disease, its spread was slow and local.

TAYLOR (J. S.). **Report on Cotton Insect and Disease Investigations Part II. Notes on the American Bollworm** (*Heliothis obsoleta*, **Fabr.) on Cotton, and on its Parasite** *Microbracon brevicornis*, **Wesm.**—*Sci. Bull. Dept. Agric. S. Afr.*, no. 113, 18 pp., 24 refs. Pretoria, 1932. Price 3*d*.

The first part of this paper (pp. 1–10) deals with the bionomics and control of *Heliothis obsoleta*, F., as a pest of cotton in South Africa. All stages are described, and a list is given of its food-plants. The following parasites have been obtained: *Trichogramma* sp., *T. lutea*, Gir., an unidentified Scelionid, and *Phanurus* sp., from the eggs; and the Tachinids, *Paratachina ingens*, B. & B., *Linnaemyia longirostris*, Macq., *L.* (*Micropalpus*) *affinis*, Corti, *Sturmia laxa*, Curr., *Tricholyga sorbillans*, Wied., and *Phorocera blepharipa*, B. & B., the Ichneumonid, *Metopius discolor*, Tosq., and *Microbracon brevicornis*, Wesm., from the larvae. Predators observed attacking bollworms in general are: the Pentatomids, *Macrorhaphis spurcata*, Wlk., and *Glypsus conspicuus*, Westw.; the Reduviids, *Rhinocoris segmentarius*, Germ., *R. albopunctatus*, Stål, and *Coranus papillosus*, Thnb.; and *Eumenes maxillosus*, DeG. These natural enemies do not appear to exert much control over *H. obsoleta*.

In the second part, notes are given on the bionomics of *Microbracon brevicornis*. Up to the present this parasite has only been recorded from one district in the Transvaal. It first appears in the field early in September, when the larvae of *H. obsoleta* are present on plants of the genus *Antirrhinum*, and increases in numbers until about mid-November, after which it gradually becomes less numerous, disappearing in January, the end of the flowering period of these plants. With only

one exception, it has not been observed to attack *H. obsoleta* on plants of any other genus. The parasite has, however, been induced to oviposit on this host on cotton by placing tins containing flowering *Antirrhinum* in a cotton field and liberating a number of larvae of *Heliothis* on the cotton plants and a small number of adult parasites in the vicinity of the tins. Moreover when confined on cotton bolls with larvae of *Diparopsis castanea*, Hmps., it parasitised this species.

The parasite usually deposits 3–8 eggs on each host, but the number of larvae that are able to mature depends on the size of the latter. If they are overcrowded, they either fail to complete their development, or the resulting adults are stunted. In one case, however, 53 adults were reared from a larva of *Xanthodes graellsi*, Feisth. During the summer, the egg stage occupies 32–48 hours, the larval 4–5 days, and the pupal (taken as the period from the commencement of spinning the cocoon until the emergence of the adult) 6–8. Before oviposition, which may take place the day after emergence, the females feed at the punctures they make in the host larvae. The number of eggs laid varies from 50 to over 670, with an average of 200 for eleven individuals. Hibernation probably occurs in the adult stage. Experiments on the effect of cool storage showed that the maximum period during which the pupae could be kept at 40–56°F. without suffering any ill effects was 28 hours, after which 78 per cent. gave rise to adults. Similar experiments with the adults showed that it is doubtful whether they could be kept in a healthy condition at an average temperature of 40°F. for more than three weeks. The technique employed in breeding the parasite is discussed; *Euxoa segetum*, Schiff., proved the most satisfactory laboratory host. Further work on *M. brevicornis* in connection with *H. obsoleta* has been abandoned for reasons which include the fact that it is difficult to rear under humid conditions, and the probability that humidity is also a limiting factor in the field. Moreover even if it would attack the larvae on cotton, the relatively long period during which they must remain more or less exposed on the plants before the parasites can reach maturity renders them an easy prey to the ants that usually abound in cotton fields.

[Goloviznin (D. D.), Kharin (S. A.) & Tzuigankov (S. K.).] **Головизнин (Д. Д.), Харин (С. А.) и Цыганков (С. К.). The Control of Cotton Pests by mechanical Means.** [*In Russian.*]—Roy. 8vo, 80 pp., 86 figs. Moscow, OGIZ, 1931. Price 4 *rub.* 50 *kop.* [Recd. September 1932.]

This handbook contains descriptions of 14 dusting and spraying machines manufactured in countries outside the Russian Union that may be employed in the control of cotton pests in Central Asia, with instructions for using them and notes on their working capacity, advantages and disadvantages. It is based on the results of field tests with a large number of machines.

[Puzirniĭ (R.).] **Пузирний (Р.). The Winter Crops Noctuid and its Control.** [*In Ukrainian.*]—Demy 8vo, 64 pp., 24 figs., 38 refs. Kharkiv, Ukr. nauk. Inst. Zakh. Roslin [Pub. Ukrain. Sci. Inst. Prot. Plants], 1932.

A popular but detailed account is given of the bionomics and control of *Euxoa segetum*, Schiff., which in the Ukraine is an important pest of winter wheat and rye and a great number of other cultivated crops,

being sometimes particularly injurious to sugar-beet. All stages are described. The information given is almost entirely based on the literature and is to a great extent similar to that in a paper already noticed [*R.A.E.*, A, xix, 385].

[Pliginskiĭ (V. G.).] **Плигинский (В. Г.). Massnahmen zur Bekämpfung des Wiesenzündlers im Jahre 1929 in den rübesäenden Bezirken im östlichen Teil des zentralen Tschernosemgebietes.** [The Control of the Meadow Moth in 1929 in the Beet-growing Regions of the eastern Part of the Central Black Soil Zone.]—*The Meadow Moth in 1929–1930* [*in Russian*], pt. ii, pp. 275–328, 1 fig., 171 refs. Kiev, Izd. Ukr. nauchno-issled. Inst. sakharn. Promuishl., 1932.

This is a review of the measures applied against *Loxostege sticticalis*, L., in central Russia in 1929, when a severe outbreak occurred throughout the whole Black Soil Zone [*cf. R.A.E.*, A, xix, 521–526]. They comprised mechanical, agricultural and chemical means, and are dealt with under four groups, according to the individual stages against which they were directed. The success or failure of each measure is recorded, and the causes of the latter are briefly discussed. The more successful ones included : the destruction of weeds on the edges of beet fields in order to prevent oviposition : ploughing fallow land after the flight of the moths was over with a view to destroying the eggs ; spraying with barium chloride against the larvae, which was only effective if the weather was dry ; killing the larvae with poisoned baits of leaves treated with a mixture of 4 oz. sodium arsenite, 4 oz. unslaked lime, 1 lb. molasses and 12 gals. water, or with Paris green ; hand collection of the larvae ; mowing the infested crops and, in the case of beet, prompt covering of the stumps with a layer of soil ; and allowing poultry to run in the infested fields.

A table is given showing the seasonal occurrence of the various stages of the moth in the different districts.

[Legatov (V. V.).] **Легатов (В. В.). The Meadow Moth in 1929.** [*In Russian.*]—*Mater. Izuchen. lugov. Motuil. Loxostege sticticalis L. v. Tz. Ch. O.* [*Materials for the Study of the Meadow Moth in the Central Black Soil Zone*], pp. 67–70, 1 map. Voronezh, Izd. Sta. Zashch. Rast. Oblzemupravl. Tz. Ch. O., 1930. [Recd. September 1932.]

An account is given of the seasonal occurrence of *Loxostege sticticalis*, L., in the Tambov Government during the outbreak that occurred in 1929 throughout the whole Black Soil Zone in central Russia [*cf. R.A.E.*, A, xix, 521–526]. Serious damage by the larvae of the first generation was caused in the south-eastern districts, but in the north most of them died while hatching, probably owing to a very dry and hot east wind that prevailed at the time. The first generation adults were exceedingly abundant in the south in July, but 88 per cent. of the females were sterile. In the central and northern districts the percentage of sterile females was lower, and the second generation larvae were consequently more abundant and injurious. Owing to warm and wet weather in August about 50 per cent. completed development and produced adults, but a sudden cold spell from about the end of August till mid-September caused sterility in the females. Of the larvae that entered hibernation 15–20 per cent. were parasitised.

[Aleksandrov (L. A.).] **Александров (Л. А.). On the Biology and Ecology of the Adults of the Meadow Moth in the Region of the Kursk Section of the Sugar Trust.** [*In Russian.*]—*Mater. Izuchen. lugov. Motuil. Loxostege sticticalis L. v. Tz. Ch. O.* [*Materials for the Study of the Meadow Moth in the Central Black Soil Zone*], pp. 71–106, 4 graphs, 25 refs. Voronezh, Izd. Sta. Zashch. Rast. Oblzemupravl. Tz. Ch. O., 1930. [Recd. September 1932.]

Details are given of the seasonal occurrence of *Loxostege sticticalis*, L., in the Kursk Government in 1929. The adults of the overwintered generation appeared in the second half of May, emergence being almost simultaneous in all districts, indicating that the moths were of local origin. They were especially abundant in the south and oviposited on beet, as most of the fields had already been weeded, whereas in the central and northern districts they were less numerous and eggs were laid mainly on weeds. Moreover, 60–80 per cent. of the females were sterile owing to cysts in the ovaries. In the northern districts, however, the first generation moths oviposited on beet and other cultivated crops, which were severely injured by the resulting larvae, whereas in the south and central districts heat and drought affected the females and in 80 per cent. cysts were found in the ovaries, so that the number of second generation larvae was negligible. The adults of the second generation were on the wing in the second half of August, but in early September, when the temperature fell suddenly, they practically all disappeared, and only a few eggs were laid in some localities.

[Pliginskiĭ (V. G.).] **Плигинский (В. Г.). The Meadow Moth in 1929 in the Beet-growing Region of the eastern Section of the Sugar Trust.** [*In Russian.*]—*Mater. Izuchen. lugov. Motuil. Loxostege sticticalis L. v. Tz. Ch. O.* [*Materials for the Study of the Meadow Moth in the Central Black Soil Zone*], pp. 107–181, 1 map, 1 graph, 72 refs. Voronezh, Izd. Sta. Zashch. Rast. Oblzemupravl. Tz. Ch. O., 1930. [Recd. September 1932.]

This report is devoted to the outbreak of *Loxostege sticticalis*, L., in the Voronezh, Orel and Kursk Governments in 1929. The seasonal occurrence of the adults and larvae and the damage caused are discussed, the losses incurred being estimated at approximately 2½ million roubles. There were two generations; some larvae of the second pupated and produced adults but others entered the soil for hibernation. The females of all generations emerged with immature ovaries, and in the case of the moths of the first generation, which were on the wing throughout July, development was very slow; in the southern districts few eggs were laid owing to the infestation of the ovaries by a fungus of the genus *Isaria* [*cf. R.A.E.*, A, xvii, 144; xix, 368], whereas in the north the females were fertile and gave rise to numerous larvae. Oviposition occurred chiefly on *Atriplex* and other weeds, and infestation was more severe in beet fields where these weeds were abundant. A list is given of the wild and cultivated food-plants of the larvae. Observations on their migration showed that it was chiefly due to lack of food and that it usually followed a direction at right angles to the wind. Parasitism among the larvae of the first generation was negligible, whereas in some localities 14–100 per cent. of those of the second were attacked by Tachinids. In one locality the larvae of the second generation were killed by a fungus. Rooks destroyed both

larvae and pupae. A list is given of the natural enemies of *L. sticticalis* recorded in the literature. The moths of the second generation, which occurred from about 20th August till about 7th September, were sterile and did not oviposit, probably owing to insufficient nourishment as a result of the scarcity of flowers.

[Bogoyavlenskiĭ (S. G.).] **Богоявленский (С. Г.). The Meadow Moth and Apiculture.** [*In Russian.*]—*Mater. Izuchen. lugov. Motuil. Loxostege sticticalis L. v. Tz. Ch. O.* [*Materials for the Study of the Meadow Moth in the Central Black Soil Zone*], pp. 182–187, 1 diag., 4 figs. Voronezh, Izd. Sta. Zashch. Rast. Oblzemupravl. Tz. Ch. O., 1930. [Recd. September 1932.]

During the severe outbreak of *Loxostege sticticalis*, L., in 1929 on sugar-beet in the Voronezh Government, the bees were deprived of the nectar in the flowers, as it was consumed by the young adult moths, which require supplementary feeding before oviposition. Cage observations indicated that these moths pollinate flowers, though to a less extent than the bees.

Kufferath (H.) & Ghesquière (J.). **La mosaïque du manioc.**—*C. R. Soc. Biol.*, cix, pp. 1146–1148. Paris, 1932.

In the course of expeditions in the Belgian Congo, one of the authors (Ghesquière) was able to establish that mosaic disease of cassava (*Manihot utilissima*) is transmitted by an Aleurodid hitherto undescribed. The adults of both sexes alone transmit the disease, the immature stages, which are attached in isolated positions to the lower surfaces of the leaves, not being concerned. The incubation period of the disease is at least 6–8 days ; discoloured patches spread from the point of inoculation among the secondary veins, and extend irregularly over areas that merge into each other. Infection has also been observed in *Manihot dulcis* var. *aipi* and *M. glaziovii*.

Living slips of infected *Manihot* have recently been transported from the Congo to the laboratory in Brussels, where they have been successfully cultivated and showed typical symptoms of the disease. Cultures of the virus were then isolated and found to contain a series of micro-organisms, and healthy plants inoculated with them became infected.

Owen, jr. (W. L.) & Calhoun (S. L.). **Biology of the Pink Bollworm at Presidio, Texas.**—*J. Econ. Ent.*, xxv, no. 4, pp. 746–751. Geneva, N.Y., August 1932.

The more important results of studies carried out at Presidio, Texas, from 1928 to 1931 concerning the life-cycle and seasonal history of *Platyedra* (*Pectinophora*) *gossypiella*, Saund., are briefly summarised. During this period the annual rainfall ranged from 7·5 inches in 1928 to 9·95 inches in 1931. Although fairly heavy precipitation may occur during any month, the heaviest rainfall usually occurs from July to October. The maximum temperature recorded was 112°F. in June 1928, and the minimum 10°F. in December 1929. Temperatures of 100°F. and over occurred as early as March and as late as October, but were frequent from June to September. The data presented were taken from observations made in a screened insectary and in cotton fields and were closely correlated with temperature and humidity records.

The following is almost entirely taken from the authors' summary: The period and rate of emergence of long-cycle moths (*i.e.*, those resulting from overwintered long-cycle larvae) were found to be governed largely by temperature and rainfall. The peak of emergence occurred on 25th April in 1928, 11th May in 1929 and 13th June in 1930. Available moisture and the addition of fresh branches bearing leaves and young squares increased the longevity of the long-cycle moths in cages considerably; in these circumstances the average life of females was 11·62 days and the maximum for both sexes was 24. Short-cycle moths (*i.e.*, those from larvae developed in bolls during the current year) lived for a longer period and possessed greater reproductive powers than long-cycle moths. The females usually began oviposition on the third day after emergence, and the largest average number of eggs laid during any 12-hour period was deposited on the first night of oviposition.

Most of the eggs hatched 4·5 days after deposition at a mean temperature of 83·04°F. The feeding and pupal periods were shorter for individuals that fed in squares than for those that fed in bolls, the total life-cycles averaging 26·6 and 32·93 days respectively. In 1931 six complete generations were developed in squares, and only three and a partial fourth in bolls. Long-cycle larvae appeared first in open bolls, then in green bolls and finally in squares. In open bolls collected from the field at 10-day intervals from 16th September to 26th October 1931, 55 per cent. of the larvae were of the long-cycle type on the first date, and those present in these bolls on the other dates of collection varied from 54·11 to 75·08 per cent.

Rude (C. S.). **Host Plant Studies of the Pink Bollworm.**—*J. Econ. Ent.*, xxv, no. 4, pp. 751–759. Geneva, N.Y., August 1932.

Studies of the food-plants of *Platyedra* (*Pectinophora*) *gossypiella*, Saund., were begun in northern Mexico in August 1928 and continued until the end of the growing season of 1931, the field observations being made in desert and mountainous country. *Hibiscus cardiophyllus* was found quite commonly infested in its native habitat, and proved capable of sustaining the bollworm from year to year if given favourable moisture conditions. *H. coulteri* and *H. denudatus*, although not found infested in nature, were attacked, the former readily, the latter less so, under laboratory conditions. Okra (*H. esculentus*) proved to be a favourable food-plant, but is of little importance in northern Mexico as it is but little planted. Hollyhock (*Althaea rosea*) was sometimes infested, but is probably of little importance, owing to its short growing season and the fact that it fruits so early that it is very doubtful if larvae developing in the seed capsules would ever enter the long-cycle phase.

Robinson (J. M.) & Arant (F. S.). **Eight Years of experimental Work in Boll Weevil Control on Plots receiving different Rates of Fertilizer.**—*J. Econ. Ent.*, xxv, no. 4, pp. 759–766, 5 refs. Geneva, N.Y., August 1932.

Experiments in the control of *Anthonomus grandis*, Boh., with calcium arsenate dust have been conducted in Alabama over a period of 8 years, 1924–31, on plots of cotton receiving different rates of fertiliser. Reports covering the first 5 years have already been noticed [*R.A.E.*, A, xiv, 491; xviii, 222]. Dusting was found to be necessary during

5 years of the test and unnecessary during the other 3. The date of the first 10 per cent. infestation varied from 13th June in 1927 to 27th August in 1926. Applications of dust were made during the day when the air was relatively calm. There was little increase in yield from dusting the unfertilised cotton. The average gains from dusting were 246, 409, 396 and 365 lb. of seed cotton per acre on the plots receiving 500, 1,000, 1,500 and 2,000 lb. of fertiliser respectively. The number of dustings per season varied from 3 to 11, with an average of 5·2, and the amount of calcium arsenate required per acre from 21 to 77 lb., with an average of 36. The average annual cost of the dusting operation was approximately £1 (at par) per acre.

Cook (W. S.). **Technique for artificial Inoculations of the Cotton Plant.**—*J. Econ. Ent.*, xxv, no. 4, pp. 766–769, 1 pl. Geneva, N.Y., August 1932.

Preliminary tests on cotton plants carried out with a view to duplicating artificially the damage caused by the cotton fleahopper [*Psallus seriatus*, Reut.] showed that artificial inoculations, without a great deal of mechanical injury, might be made by means of fine capillary glass points handled with a micro-manipulator. The apparatus and technique are described.

Gaines (J. C.). **Migration and Population Studies of the Cotton Bollworm Moth** (*Heliothis obsoleta* **Fab.**).—*J. Econ. Ent.*, xxv, no. 4, pp. 769–772, 2 pls., 1 ref. Geneva, N.Y., August 1932.

In an attempt to ascertain the causes influencing the migration of *Heliothis obsoleta*, F., from maize to cotton, a wheeled trap was used in Texas in 1930 and 1931. The framework, which was 8 ft. long and wide enough to cover two rows of cotton, was covered with screen wire, into which the moths flew, mounted on two bicycle wheels and pushed along the rows. This trap was quite successful in obtaining information regarding the extent of local migration and the abundance of moths in the field.

Between 28th July and 9th September 312 moths from one cotton field were caught, marked and released on ten different days. Moth collections were made at distances of 150 and 280 yards and one mile from the point of release, and no marked moths were recaptured. Only 23 per cent. of the moths were released when the cotton was making its most rapid growth. In the later part of the collecting period determinations showed that the sexes were about equally divided, the males slightly predominating. This proportion also occurred among adults reared from an adjacent maize field and indicated that the trap captured typical samples. In order to determine the number of moths to the acre and their relation to the infestation, the trap was pushed over $2\frac{1}{2}$ acres of rank and of small cotton about twice a week over a period of 51 days during which the first and second generation moths in cotton would be flying. The catches were recorded and correlated with the number of eggs to the acre, forms injured and average plant growth, throughout the period. It was found that oviposition and rate of plant growth were closely associated, but that there was no relation between the moth population and oviposition in the fields studied.

RUDE (C. S.) & SMITH (C. L.). **Observations on a combined Boll Weevil and Pink Bollworm Infestation in northern Mexico.**—*J. Econ. Ent.*, xxv, no. 4, pp. 772–776, 1 graph. Geneva, N.Y., August 1932.

Observations were carried out in 1931 on a heavy infestation of cotton by *Anthonomus grandis*, Boh., discovered in northern Mexico, in conjunction with an infestation by *Platyedra* (*Pectinophora*) *gossypiella*, Saund., in the course of which weekly records were made of the percentage of square and boll infestations by both species. It was found that the multiplication and development of either pest was not checked by that of the other.

RONEY (J. N.). **Relation between Wind Distribution of winged Forms and Infestation of the Turnip Aphis,** *Rhopalosiphum pseudobrassicae* **Davis.**—*J. Econ. Ent.*, xxv, no. 4, pp. 776–780, 1 fig. Geneva, N.Y., August 1932.

The production of turnips, mustard and radishes has recently been greatly reduced on the coastal plain of Texas, mainly owing to damage caused by *Aphis* (*Rhopalosiphum*) *pseudobrassicae*, Davis. This has been largely due to the increased cultivation of late summer crops, which are usually left without being ploughed and enable the Aphids to pass the critical summer period in greater abundance, after which they multiply rapidly and migrate readily to the young autumn plantings. In order the measure the influence of the old, neglected and infested plantings, records during the autumn of 1930 and following winter were obtained on the numbers and significance of migratory Aphids, their relation to infestation and their spread to other plantings. In the dry summer of that year, however, very few plantings had been made.

Autumn plantings of mustard, turnip and radish began to come up in abundance by the middle of October. Winged forms were found on half the plantings by 1st November, and by 1st December they had spread to all but one. The average number of winged forms per 100 leaves, however, did not exceed 8 at any point during October, November or December, indicating very slow development when there were practically no summer plantings from which the Aphid could spread. With the exception of the March plantings, which became 100 per cent. infested as soon as they came up, all crops of the season became approximately 100 per cent. infested between 22nd January and 26th February, although the time of planting them extended through a period of 119 days. During February 210 winged forms per 100 leaves were found at each examination on all plantings, under which conditions complete destruction takes place so far as commercial value is concerned.

The effect of some plantings upon others in the same community, especially when in line with the prevailing winds, is illustrated in the time taken for infestation to reach 100 per cent. Catches on adhesive screens showed that in one case nearly one-fourth as many Aphids were being carried $\frac{1}{4}$ mile away from crops as were being caught close to them, and a few Aphids were caught at a distance of $3\frac{1}{2}$ miles from the crops on the further side of a barrier of trees.

Butler (H. G.). **Observations on the Biology of the Peach Borer in Roane County, Tennessee, Harriman, Tenn., 1931.**—*J. Econ. Ent.*, xxv, no. 4, pp. 781–786, 1 fig. Geneva, N.Y., August 1932.

In an experiment on the control of *Aegeria* (*Synanthedon*) *exitiosa*, Say, in Tennessee, standard applications of 1 oz. of paradichlorobenzene were made in a circle about the bases of experimental peach trees. Different trees were treated on 15th September, 1st October, 15th October and 1st November 1930. The paradichlorobenzene was removed from some of the trees after 4 or 6 weeks' exposure, and others were exposed until 25th January. Some of the trees were used to determine the effects of treatment by autumn examination, the earth from the immediate vicinity of the base of the tree being removed and the bark cut away to expose the larvae. The results of the various treatments were also determined by the emergence of moths, as indicated by the presence of cast pupal skins during the following summer. In comparing the trees exposed for 6 weeks with those treated on the same dates and exposed for a longer period, it was found that in each case the longer exposure gave a higher degree of control. Treatment started on 1st October was clearly superior to the others, in blocks having a longer period of exposure.

Daily observations of the emergence of the moths from the soil were started on 11th June 1931, when the first was observed, and continued until 21st September. The period of greatest emergence occurred between 4th and 7th September. A circle of wire screening 15 inches in diameter had been installed about the base of each tree to protect the pupating forms from predators. Although the field of emergence extended for a distance of 30 inches from the trunk of the tree, 56·7 per cent. of the moths emerged within the barrier, and 36·7 per cent. within 1 ft. of it. A large proportion of the pupating forms outside the barriers were destroyed by predators. Insectary studies showed the average potential oviposition of 25 moths to be 767·2 eggs each during the season of 1931. In the insectary, where eggs laid in captivity were found to hatch if moisture was supplied, the average incubation period of 421 eggs was 9·2 days.

Snapp (O. I.). **A new Method of controlling the Peach Borer, *Synanthedon exitiosa* Say, with special Application to young Trees.**—*J. Econ. Ent.*, xxv, no. 4, pp. 786–799, 2 refs. Geneva, N.Y., August 1932.

In the course of experiments carried out in Georgia in 1930 and 1931, in continuation of work in the control of *Aegeria* (*Synanthedon*) *exitiosa*, Say, conducted there since 1921 [*cf. R.A.E.*, A, xvi, 454; xviii, 66], paradichlorobenzene-crude cottonseed oil emulsion was applied as a spray at various strengths to peach trees one, two, three, six and seven years old. The experiments of 1931 included also paradichlorobenzene-mineral oil emulsion and naphthalene-crude cottonseed oil emulsion applied as sprays at various strengths and paradichlorobenzene or naphthalene crystals applied in a continuous band on the ground about 1½ inches from the tree trunk. The sprays were made by dissolving 2 lb. of the chemical in 1 U.S. gal. of the oil, emulsifying with potash fish-oil soap and diluting with water so that 1 U.S. pint carried the desired dosage for a tree. They were sprayed at a pressure of 50 lb. on the lower part of the trunk and the ground round it. Paradichlorobenzene-oil emulsions carrying ¼ oz. of the

chemical to each one- or two-year-old tree, ½ oz. to each three-year-old tree, and 1 oz. to each six- or seven-year-old tree, with shovelfuls of earth placed around the tree after spraying, proved to be safe and very effective against *A. exitiosa*. These emulsions applied as sprays are apparently the only safe means of control for trees one, two or three years old under conditions prevailing in the southern United States. This method of control is an improvement over treatment with paradichlorobenzene crystals, as it is easier to use and takes less time for application. Naphthalene-crude cottonseed oil emulsion and naphthalene crystals were ineffective and injurious to peach trees.

Nettles (W. C.). **Oriental Fruit Moth Studies in South Carolina—1931.**—*J. Econ. Ent.*, xxv, no. 4, pp. 799–807, 3 figs., 8 refs. Geneva, N.Y., August 1932.

Absence of severe injury to peaches by *Cydia* (*Grapholitha*) *molesta*, Busck, for two consecutive years in South Carolina, where serious infestation had occurred in 1929, was mainly attributable to the introduced parasite, *Macrocentrus ancylivora*, Rohw., and to retardation of oviposition by excessively high sunset temperatures during late June and early July. A study of the larval parasites of *C. molesta* in 1931 demonstrated the ability of *M. ancylivora* to survive successfully the winter of 1930–31 in the absence of *Ancylis comptana*, Froehl. During the season 34·5 per cent. of the larvae of *C. molesta* were destroyed by parasites, and all but about 1·7 per cent. of the parasitism can be attributed to *M. ancylivora*. There appeared to be a synchronisation between the abundance of the parasite and that of the host prior to the time of the Elberta peach harvest.

Insectary studies indicate that there is a definite relationship between temperatures at sunset and egg deposition by *C. molesta*. Oviposition did not occur when the sunset temperatures were lower than 60°F., and was gradually accelerated as temperatures rose to the optimum of between 76 and 85°F., but was greatly retarded when sunset temperatures in excess of 85°F. were recorded. Considerable significance is attached to the fact that sunset temperatures were unusually high and oviposition materially reduced during the 12-day period 22nd June to 2nd July, which coincided with one-third of the time (4th June–10th July) during which second brood eggs were being deposited.

Life-history studies with regard to picking time of Elberta peaches indicate that overwintering larvae could have developed in late-ripening peaches, especially in dropped fruit or those left on the trees, and in all varieties ripening later than Elbertas. Elberta peaches had completed blooming before the occurrence of the peak of emergence of the spring brood and were in full bloom when the first moths emerged (18th March). These peaches were picked at about the time of hatching of the fourth brood eggs and after the majority of third-brood larvae had left the fruit. The first overwintering larvae hatched 4 days before the picking of the last Elberta peaches.

Snapp (O. I.) & Thomson (J. R.). **A Progress Report on feeding Tests and spraying and dusting Experiments for the Control of the Plum Curculio.**—*J. Econ. Ent.*, xxv, no. 4, pp. 811–815, 1 ref. Geneva, N.Y., August 1932.

As in previous experiments [*R.A.E.*, A, xvi, 398] sodium fluosilicate without lime was highly injurious to peach foliage and fruit, and lime

destroyed the toxicity of the insecticide to *Conotrachelus nenuphar*, Hbst. (plum curculio), experiments were conducted with a number of fluosilicates in 1928 and 1929 in an attempt to discover one that would cause no injury to peach fruit or foliage. Potassium fluosilicate without lime proved safest during these seasons, and a number of feeding tests were conducted in 1930 to determine its toxicity as an insecticide.

The following is taken from the authors' summary of the results secured : Feeding tests showed potassium fluosilicate at the rate of 2 lb. to 50 U.S. gals. water to be a little more toxic to *C. nenuphar* than lead arsenate (1 lb. to 50 U.S. gals). Furthermore, potassium fluosilicate was somewhat more toxic to *C. nenuphar* than barium fluosilicate or cryolite. Wettable sulphur increased the toxicity of fluosilicates as insecticides for the weevil. The toxicity of these insecticides was considerably reduced when they were used at the rate of $\frac{1}{4}$ or $\frac{1}{2}$ lb. to 50 U.S. gals. water. Calcium monosulphide greatly decreased the toxicity of the potassium fluosilicate, which may have been due to its repellent action. Lead arsenate dusts were not so toxic as the spray. Copper carbonate, wettable sulphur, and zinc sulphate-lime spray, when used alone, were not toxic to the plum curculio.

Four applications of potassium fluosilicate, barium fluosilicate or cryolite, at the rate of 2 lb. to 50 U.S. gals. water, with and without wettable sulphur, caused no injury to foliage, fruit or budwood of peach trees. Four applications of lead arsenate at the rate of 1 lb. to 50 U.S. gals. water with lime scorched 2·5 per cent. of the fruit and caused moderate to heavy foliage injury, with considerable defoliation and occasional budwood injury. Four applications of lead arsenate of the same strength with zinc-lime spray scorched 9·2 per cent. of the fruit and caused light to moderate foliage injury, with very little defoliation, and no budwood injury.

Three applications of dust containing 10 per cent. lead arsenate caused moderate injury to the foliage with considerable defoliation, but no budwood injury. Three applications of lead arsenate spray at the rate of 1 lb. to 50 U.S. gals. water with lime caused moderate foliage injury but not so much defoliation as the 10 per cent. dust, and no budwood injury. There was practically no foliage injury from 3 applications of dust containing 5 per cent. lead arsenate.

HERBERT (F. B.). **Effect of Cold Storage Temperatures on the Argentine Ant.**—*J. Econ. Ent.*, xxv, no. 4, pp. 832–833. Geneva, N.Y., August 1932.

Experiments with large numbers of Argentine ants [*Iridomyrmex humilis*, Mayr] indicate that they will succumb in 24 hours if kept at 31°F., or in a shorter time at lower temperatures.

CHAMBERLIN (W. J.). **Notes on the Synonymy, Hosts and Distribution of some Buprestidae (Coleoptera).**—*J. Econ. Ent.*, xxv, no. 4, pp. 833–836, 1 fig., 6 refs. Geneva, N.Y., August 1932.

Records are given showing the extension of distribution of certain Buprestids in the United States and Canada. The species dealt with include *Buprestis adjecta*, Lec., and *Chrysobothris monticola*, Fall, on *Pinus contorta* in Oregon and British Columbia, respectively ; *C. nixa*, Horn, on *Thuja plicata* in Vancouver Island ; and *C. fragariae*, Fisher, on *Geum* in Oregon and California and strawberry in Oregon. An

adult of *B. aurulenta*, L., was found with two eggs of a Tachinid attached to its back. The beetle died, and though the eggs hatched, it was not ascertained whether the maggots found their way through the exoskeleton. This is the first instance of parasitism of an adult Buprestid observed by the author, although he has examined many hundred specimens during the last 15 years.

Mail (G. A.). **pH and Wireworm Incidence.**—*J. Econ. Ent.*, xxv, no. 4, pp. 836–840, 6 refs. Geneva, N.Y., August 1932.

The following is taken from the author's abstract and summary: The effect of soil acidity or alkalinity on the abundance of wireworms in Montana is studied. Laboratory experiments show that larvae of *Pheletes* (*Limonius*) *canus*, Lec., can tolerate a much wider range of pH than is commonly found in nature in the agricultural lands of Montana. This is substantiated by field records. The range of pH to which the wireworms were subjected in the laboratory was 4·8 to 8·2. In nature the pH limits of the fields studied were 6·1 to 7·7. It is therefore concluded that the pH value of the soils of Montana that are suitable for agriculture has no influence on the presence of wireworms.

McDaniel (E. I.). **The Strawberry Root-weevil, *Brachyrhinus* (*Otiorhynchus*) *ovatus* as a Conifer Pest.**—*J. Econ. Ent.*, xxv, no. 4, pp. 841–843. Geneva, N.Y., August 1932.

Injury caused by *Otiorrhynchus* (*Brachyrrhinus*) *ovatus*, L., in a conifer nursery in Michigan has steadily increased since the infestation was first discovered in 1929 [*R.A.E.*, A, xviii, 381]. In 1930 at least two-thirds of the three-year-old seedlings were killed, and in 1931 all three-year-old plantings of white cedar [*Thuja occidentalis*] and various species of pine and spruce were a total loss. As no injury from this weevil has been detected in adjacent strawberry plantations or on wild berries, it appears that a distinct race has developed, the larvae of which feed only on the root-systems of two- and three-year-old conifer seedlings growing in seed-beds. When caged with strawberry plants both in the open and in the laboratory, the larvae and adults starved, whereas those caged on conifers developed normally. The infestation has been built up among growing conifers for about 25 years in a comparatively restricted area.

Experiments showed that the larvae in the soil can be killed by the use of carbon bisulphide emulsion. With an emulsion containing 50 per cent. carbon bisulphide, dilutions varying from 68 cc. at soil temperatures of 40–50°F. to 45 cc. at 60–70°F. in 10 U.S. gals. water have been effective, 2½ U.S. gals. of the diluted emulsion being used to the square foot. The soil should be left undisturbed for 48 hours after treatment. The adults can be killed by a poisoned bran bait containing oil of apples as an attractant.

Ingram (J. W.) & Bynum (E. K.). **Observations on the Sugarcane Beetle in Louisiana.**—*J. Econ. Ent.*, xxv, no. 4, pp. 844–849, 2 refs. Geneva, N.Y., August 1932.

Sugar-cane is injured in Louisiana by the gnawing of the adults of the Dynastid, *Euetheola rugiceps*, Lec., into the underground stems of

the young plants [*R.A.E.*, A, xix, 675]. After hibernating in the ground, they cause injury from April to the first part of June. They are active above ground mainly at night, although they have been observed on the surface in the daytime. Oviposition begins in April and is heaviest during late May and early June, although eggs have been deposited as late as 14th August. Most of the overwintered beetles die in June or July, but some live until late summer. Eggs are deposited near the food-plant beneath the surface of the soil and hatch in two weeks. The larvae feed on various rotting materials, such as cane trash, grass roots and plants killed by the adults. A few pupate rapidly but in most cases pupation is delayed. Adults emerge from the early pupae in July and from very late pupae in September, but the majority appear in August. Newly emerged beetles have been found feeding on old cane plants and on summer plant cane, but the injury caused at this time appears to be of little economic importance. Beetles were last found feeding in the field on 17th October.

The injury takes the form of ragged holes gnawed in the shoot just below the surface of the ground, which usually kill it. Counts of dead shoots made throughout the sugar-cane section have revealed in some instances 70 per cent. injury. No field has yet been observed where all the shoots were killed at any one date, but there is evidence that all the original shoots in a field may be killed at some time during the season, though suckers sometimes grow from plants that are apparently dead. Losses are usually more severe in plant than in stubble cane, which has greater ability to put out suckers from injured shoots.

Examination of soil to a depth of 8 inches in different areas on a sugar plantation during the time between the occurrence of oviposition and the emergence of the beetles showed that the numbers of this Dynastid present varied from none in woodland to 100,000 to the acre in pasture land. It was seen that plant cane and first year stubble must certainly be infested from beetles breeding outside the fields, whereas second year stubble is infested from outside to a less extent. Estimating that one beetle will kill two original shoots, beetles from one acre of pasture land would be capable of attacking all original shoots in 23·9 acres of plant cane.

As regards natural control, the effect of which is evident in marked fluctuations in the numbers of beetles from year to year, many larvae and pupae are probably killed when the soil remains water-logged for several days, but drought seems to have little effect. Skunks and a number of birds feed upon the adults, which are parasitised by *Sarcophaga rapax*, Wlk. (*helicis*, Towns.). The larvae are parasitised by a Tachinid, *Microphthalma disjuncta*, Wied.

Treatment of plant cane with lime, suphur, borax and calcium arsenate was found to be of little value in control, and hydrogen-ion determinations gave little indication that beetle damage was affected by acidity or alkalinity of the soil. Hand collection of beetles was found to be of doubtful value, and attraction to light was too small to be worth utilising. Owing to the much greater number of early cane shoots produced by planting in the summer rather than in the autumn, the former practice affords a much better chance than the latter of producing a crop in areas where the beetle is a serious problem. Elimination of breeding grounds by cultivation of pasture land in the neighbourhood of plantations and other cultural measures are suggested.

Haseman (L.) & Johnson (P. H.). **Timing the Spray Application by the Emergence of the Codling Moth.**—*J. Econ. Ent.*, xxv, no. 4, pp. 849–855, 2 graphs. Geneva, N.Y., August 1932.

In the control of *Cydia* (*Carpocapsa*) *pomonella*, L., it is important that the spray applications subsequent to the calyx spray be timed so that there will be a maximum of fresh coverage on the fruit and foliage when there is a maximum of larvae entering the fruit. Breeding experiments have shown that the moths do not emerge from year to year according to calendar dates or with any definite reference to the blooming date of apples. By the use of breeding cages and bait traps in Missouri, the adult and larval development of the moth is followed throughout the spring, summer and early autumn, and control equal to or better than that obtained with 9–10 applications under the former methods has thus been secured with 6–7 properly timed sprays. The department of entomology determines moth emergence for each important centre, and every apple grower in the State receives a recommendation as to the time of application of the sprays. The growers themselves in some cases run bait traps and send in records of data to check the accuracy of the central recommendations. The analysis and application of the data are discussed.

Hensill (G. S.). **Orchard Sanitation and the Codling Moth.**—*J. Econ. Ent.*, xxv, no. 4, pp. 856–859. Geneva, N.Y., August 1932.

An account is given of records obtained by means of bait traps of an unusually heavy flight of *Cydia* (*Carpocapsa*) *pomonella*, L., that occurred in an apple section of the Santa Clara Valley, California, in 1931. Lack of orchard sanitation definitely accounts for the conditions described. Large quantities of infested fruit had been left on the ground, and it was common to find as many as 300 larvae under a single 3-inch two-layer burlap band. Infrequent pruning and cultivation together with frequent irrigation had favoured the growth of weeds and consequently promoted pupation. The trees had never been sufficiently scraped, and the rough bark and dead pruning cuts made ideal situations for pupation. There was also a lack of adequate banding.

Barrett (R. E.). **Relative Toxicity of some Dusts to** *Carpocapsa pomonella*.—*J. Econ. Ent.*, xxv, no. 4, pp. 859–863, 2 refs. Geneva, N.Y., August 1932.

Acid lead arsenate cannot be used on English walnut, which is extremely sensitive to water-soluble arsenic, and a basic lead arsenate having not more than 0·25 per cent. arsenic in water-soluble form has to be employed. This is much less toxic and has not proved altogether satisfactory in protecting walnuts from *Cydia* (*Carpocapsa*) *pomonella*, L. A number of other materials were therefore tested in 1930 and 1931. Fluorine compounds were dusted at the rate of 2 lb. to the tree. Barium fluoride, magnesium fluosilicate, sodium fluoride and zinc magnesium fluosilicate entirely defoliated the trees and killed the current year's wood. Sodium fluosilicate scorched the tips and margins of the leaves and the husk of the nuts, although it did not cause very severe defoliation. Barium fluosilicate and synthetic cryolite were selected for additional study and tested in the laboratory as dusts on walnuts and apples against *C. pomonella*. Basic lead arsenate, lime,

and talc of three degrees of fineness were similarly tested. Some protection was obtained from both lime and talc. In talc the fineness of mesh had considerable bearing on the protection afforded. Talc of 400 mesh gave slightly less than twice the protection afforded by lime. The larvae were so impeded by it that they often fell from the surface of the nut, this being also observed with the fine synthetic cryolite used.

Interpretation of the results obtained with lead arsenate and the two fluorine compounds was difficult on walnut, but on apple barium fluosilicate gave approximately four times the protection that basic lead arsenate furnished. It appears that a dust of 35 per cent. barium fluosilicate and 65 per cent. talc of 400 mesh should give much better results than the standard dust of basic lead arsenate and lime in the same proportions.

STEINER (L. F.). **Observations on the Distribution of the hibernating Oriental Fruit Worms.**—*J. Econ. Ent.*, xxv, no. 4, pp. 864–868. Geneva, N.Y., August 1932.

The following is taken from the author's summary: The efficiency of early spring cultivation and paradichlorobenzene treatment as applied against the peach borer [*Aegeria exitiosa*, Say] in the control of *Cydia* (*Laspeyresia*) *molesta*, Busck, is dependent upon the distribution of the surviving hibernating population on and about the tree. Examination of ten peach trees in southern Indiana indicated that this distribution is extremely variable and subject to such factors as variety, ripening date, amount of rough bark on the tree, débris on the ground, and winter mortality. The percentage of larvae hibernating on the tree varied from 100 in the case of one variety to 18·6 in the case of another. Small pieces of weeds and stems held more hibernating larvae than anything else under the trees. In 1929–30 less than 1 per cent. of the larvae hibernating above the snow line survived parasitism and low temperatures. Cultivation and the paradichlorobenzene treatment under such climatic conditions should be effective for partial control. Under normal Indiana conditions, however, they appear useless when applied to early ripening varieties, or to any variety when much of the trunk is covered with rough bark.

DICKE (F. F.). **Studies of the Host Plants of the European Corn Borer, *Pyrausta nubilalis* Hübner, in southeastern Michigan.**—*J. Econ. Ent.*, xxv, no. 4, pp. 868–878, 1 ref. Geneva, N.Y., August 1932.

In the area extending from western New England to northern Indiana and southward to the Ohio River, where *Pyrausta nubilalis*, Hb., has only a single generation a year, its habits differ somewhat from those characterising it in eastern New England [*R.A.E.*, A, xvii, 363], where there are two generations and some 200 food-plants have been found to be infested. In the western area *P. nubilalis* is almost entirely confined to maize, and all infestations in food-plants other than maize have been limited to weeds and cultivated plants in or contiguous to maize fields. Studies were carried out in heavily infested areas in Michigan from 1927 to 1929 inclusive to determine the extent of infestation in weeds, to ascertain the possibility of attack on economic plants other than maize, and finally, by forcing infestations of weeds and crop plants and returning the progeny of each generation to the same food-plant in the ensuing year, to determine establishment and

survival, longevity in the absence of maize and any change in the life-cycle. It is concluded from the data available that infestations in weeds growing among maize are brought about by larval migration from the maize. In experimental plots contiguous to maize liberal infestations have occurred in broomcorn millet (*Panicum miliaceum*), broomcorn, and other varieties of *Sorghum*, and Hungarian millet [*Setaria*] when these plants were at a stage of development attractive to the moths. The fact that *P. nubilalis* has a single generation annually in Michigan and that the moths emerge at a period when maize is abundantly present at a stage of development very attractive for oviposition has no doubt been an important factor in maintaining the close association with this food-plant.

In the absence of maize in cages, *P. nubilalis* has consistently established itself on a variety of plants, proving that it can live on cultivated plants other than maize and on common weeds in the western area.

FICHT (G. A.). **Some Studies on the Planting Rate of Corn in Relation to Oviposition, Population and Injury by the European Corn Borer.** —*J. Econ. Ent.*, xxv, no. 4, pp. 878–884, 1 ref. Geneva, N.Y., August 1932.

The following is taken from the author's summary and discussion : This report relates to some of the progress made during two seasons of study pertaining to the planting rate of maize in relation to the behaviour of *Pyrausta nubilalis*, Hb., with special reference to oviposition, population, survival and injury. Studies relative to egg distribution seemed to indicate that the eggs were not deposited on the plants directly on the basis of the number of available plant units or the unit area available for oviposition, but that such distribution was influenced more by unit area than by plant unit. The rate of survival of *P. nubilalis* from the egg to the full-grown larva seemed to be proportional to the thickness of the stand, but the thinner plantings contained the greatest borer load per plant unit and also were the most severely injured. Although these observations were made on only one variety of maize, planting date and condition of soil, and therefore can show no specific best planting rate for maize under all conditions, it seems probable that somewhat thicker stands than are ordinarily grown might be of advantage and that uniform and full stands of maize may be more important in infested than in borer-free areas.

SAKIMURA (K.). **Life History of *Thrips tabaci* L. on *Emilia sagittata* and its Host Plant Range in Hawaii.**—*J. Econ. Ent.*, xxv, no. 4, pp. 884–891, 1 fig., 11 refs. Geneva, N.Y., August 1932.

Thrips tabaci, Lind., the vector of yellow spot disease of pineapple [*R.A.E.*, A, xix, 316, 744], is an introduced species in Hawaii and is now established and distributed all over the Islands. It has been collected from 66 different plants, a list of which is given. Its life-history on *Emilia sagittata*, one of the most important wild hosts of both vector and virus, has been studied. In addition to the silvery appearance of the feeding scar, chlorotic malformation occurs as the result of heavy feeding by *T. tabaci* on the young leaves of this plant. It was found that this thrips may reproduce parthenogenetically throughout the season under Hawaiian conditions, males being rare. The average lengths of the egg stage, first and second larval instars, and

pre-pupal and pupal periods were, 4·53, 4·57, 4·57, 1·54 and 3·30 days respectively. The average adult life was 32·4 days, the pre-oviposition, oviposition and post-oviposition periods lasting 6·1, 22·5 and 3·9 days respectively. The average number of eggs laid by one unmated female was 37·4. Under prevailing Hawaiian conditions the biotic potential of this species is extremely high. A noticeable lengthening of the time required for development was observed in the cooler months, but there was no indication of hibernation. The Eulophid, *Thripoctenus russelli*, Crwfd., which is being introduced into Hawaii from California for the control of the thrips, appears to have, however, a definite hibernation period, and owing to the length of its pupal period, a much longer life-cycle. It would therefore appear that it is unlikely to be effective unless it shows a rapid adaptation to Hawaiian climatic conditions.

MYERS (L. E.). **Two Economic Greenhouse Mealybugs of Mississippi. The Citrus Mealybug and the Mexican Mealybug.**—*J. Econ. Ent.*, xxv, no. 4, pp. 891–896, 2 pls. Geneva, N.Y., August 1932.

The life-histories of *Pseudococcus citri*, Risso (citrus mealybug) and *Phenacoccus gossypii*, Towns. & Ckll. (Mexican mealybug), which are of economic importance in Mississippi, mainly in nurseries, were compared under greenhouse conditions. *P. citri* completed eight life-cycles in 365 days, whereas 381 days were required for *P. gossypii* to complete the same number. Comparative charts are given showing the length of the different stages of each mealybug. The egg-laying period for *P. citri* varied from 5 to 23 days. Females laid from 95 to 592 eggs, the average number being 307·10 or 28·92 a day. With *P. gossypii*, the oviposition period varied from 6 to 14 days. From 228 to 474 eggs were laid, the average being 402·33 or 51·14 a day. The egg sacs of the two species are compared. Mortality during development is apparently rather higher in *P. citri*. From eggs laid in each case by a single female 83 males and 106 females reached maturity in the case of *P. citri* and 143 males and 144 females in the case of *P. gossypii*. Isolated females of *P. citri* produced three successive generations parthenogenetically.

In experiments in which a single mature female of each species was placed on a *Coleus* plant, the plant infested by *P. gossypii* showed more dwarfing and wilted in 38 days after the eggs had been laid, whereas that infested by *P. citri* wilted in 50 days.

In view of the confusion existing between *P. citri* and *Pseudococcus kraunhiae*, Kuw. (Japanese mealybug), the main differences separating these two species are pointed out.

MUNRO (J. A.) & CARRUTH (L. A.). **Insecticidal Control of the Common Black Field Cricket** (*Gryllus assimilis* **Fabr.**).—*J. Econ. Ent.*, xxv, no. 4, pp. 896–902, 1 pl., 2 graphs, 6 refs. Geneva, N.Y., August 1932.

Experiments were conducted in 1931 to determine the value of various insecticides used in baits and as dusts for the control of *Gryllus assimilis*, F., a widely distributed field and household pest in North Dakota. In baits sodium fluosilicate proved the best and sodium fluoride was almost as effective, but arsenicals and thallium sulphate were unsatisfactory. Under cage conditions the addition of orange or amyl acetate did not make the bait more attractive, and the value of

adding fruit to baits for use under field conditions remains uncertain. Molasses proved a dependable attractant in baits. Of the various baits tested in the field, where they were applied at the rate of 10 lb. bran per acre, the one that gave the best results consisted of 50 lb. bran, 2½ lb. sodium fluosilicate, 1 U.S. gal. cane molasses and 6 U.S. gals. water. Examination 72 hours after the application of baits containing sodium fluosilicate showed 70–80 per cent. of the crickets killed. Grasshoppers killed by the bait comprised the following species in order of their abundance : *Dissosteira carolina*, L. (of which 19·1 per cent. were parasitised by *Sarcophaga kellyi*, Aldr.), *Melanoplus bivittatus*, Say (18·7 per cent. parasitised by *S. kellyi*), *Camnula pellucida*, Scudd., *M. femur-rubrum*, DeG. (parasitism present but not counted), *Encoptolophus sordidus*, Burm., and *Spharagemon wyomingianum*, Thomas.

In houses and other places where the bait could not be used satisfactorily, pyrethrum powder applied as a dust proved very effective in killing the crickets. In cage tests its action was more rapid than that of sodium fluoride or fluosilicate used as dusts.

Cole, jr. (A. C.). **The Olfactory Responses of the Cockroach (*Blatta orientalis*) to the more important Essential Oils and a Control Measure formulated from the Results.**—*J. Econ. Ent.*, xxv, no. 4, pp. 902–905. Geneva, N.Y., August 1932.

The responses of *Blatta orientalis*, L., to various essential oils were determined by means of an improvised Y-tube olfactometer. These responses were positive or negative depending upon the oil used in each case. There was also a small percentage of reverse responses, especially when the concentration of the oil was not high. The results of these tests are tabulated. From them the following bait was developed : 6 gm. gelatine, 200 cc. dilute beef broth, ½ gm. mercury bichloride and 1 drop of oil of either banana, sweet orange, apple or pineapple as an attractant. This bait killed the cockroaches in slightly more than 3 hours on the average. It is also toxic to house-infesting ants provided that a little sugar is added, in which case water may be substituted for the beef broth. The gelatine is dissolved in the hot broth, the mercury bichloride added and then the attractant. The material while still warm and liquid is poured into flat containers where, after cooling, it develops a gelatinous consistency and can be cut into pieces, which can be stored in tightly-sealed metal containers. The mercury bichloride, in addition to killing the cockroaches, prevents the formation of colonies of bacteria and mould on the gelatine.

Campbell (F. L.). **Preliminary Experiments on the Toxicity of certain Coal-tar Dyes for the Silkworm.**—*J. Econ. Ent.*, xxv, no. 4, pp. 905–917, 1 pl., 21 refs. Geneva, N.Y., August 1932.

The following is the author's summary : Aqueous solutions of 21 representative coal-tar dyes were administered to silkworms [*Bombyx mori*, L.] by mouth and by injection. The 11 acid dyes and 6 of the basic dyes did not kill the larvae by either method of administration at a dose of 0·05 mg. per gm. body weight. The 4 lethal basic dyes were malachite green, safranin bluish, brilliant green, and crystal violet. Their relative toxicity was in the order given when administered by the mouth ; by injection the order was 3, 1, 4, 2.

Since malachite green is more toxic than acid lead arsenate for *B. mori*, it might be desirable to use it for the colouring of white arsenicals

and fluorine compounds to comply with such laws as may be enacted on the colouring of insecticides. Malachite green and other toxic dyes, being soluble in water and not strongly adsorbed by lead and calcium arsenates, might be added to the arsenicals in the form of adsorption compounds with clays, such as bentonite. When the concentration of the dye on the clay is such that it cannot be washed out with water, it may be still liberated in the alimentary tract of the insect. The colourless insoluble leuco and colour bases of malachite green were not toxic to the silkworm.

Neutral red, when administered by the mouth, coloured the integument of third-instar silkworms. The colour was retained throughout the remainder of the larval stage. The suggestion is made that vital stains might be used for the identification of insects for experimental purposes.

A description of the construction and operation of a simple injection pipette is given. It was used not only for the injection of dyes into silkworms but also for the injection of organic liquids into the grasshopper, *Melanoplus differentialis*, Thomas. Methyl alcohol, ethyl alcohol and ether, having only a temporary effect, might be used as solvents for poisons insoluble in water. The median lethal dose of nicotine by injection into fifth instar larvae of *B. mori* was about 0·0015 mg. per gm.

Ginsburg (J. M.) & Schmitt (J. B.). **A Comparison between Rotenone and Pyrethrins as Contact Insecticides.**—*J. Econ. Ent.*, xxv, no. 4, pp. 918–922, 10 refs. Geneva, N.Y., August 1932.

Acetone extracts of derris root and pyrethrum flowers and pure rotenone were tested in the laboratory as contact poisons on Aphids and honey-bees. No spreaders were used. The results show that pyrethrum extract in dilute solutions is much more toxic to honey-bees than is either derris extract or pure rotenone. Both rotenone and derris extract, however, proved much more toxic to Aphids than did pyrethrum extract. The reversible differences in toxicity of rotenone and the pyrethrins to Aphids and honey-bees may also appear in relation to other groups of sucking insects and may throw some light upon the causes of failure to control insect pests in the case of many new insecticides at the dilutions indicated on the label. The results obtained suggest that it is dangerous for the insecticide manufacturer to test an insecticide on one group of insects and assume that others will react similarly to it.

Bullis (D. E.). **Comparison of Oxidation Rates of Liquid Lime-sulfur and Solutions of dry Lime-sulfur.**—*J. Econ. Ent.*, xxv, no. 4, pp. 922–928, 4 graphs, 2 refs. Geneva, N.Y., August 1932.

It has been shown that the insecticidal value of lime-sulphur is largely due to its power to absorb oxygen. Certain workers have maintained that the presence of sludge in dry lime-sulphur solutions may decrease the efficiency of the spray. The oxidation rates of liquid lime-sulphur and solutions of dry lime-sulphur were compared in the presence and absence of sludge with a view to obtaining information pertinent to the relative merits of the two materials. Solutions for this study were made up to contain equivalent amounts of calcium polysulphide by weight, regardless of whether the trisulphide (CaS_3), tetrasulphide (CaS_4), or pentasulphide (CaS_5) predominated. Three methods

of measuring oxidation were tested, only one of which proved satisfactory and is described in detail. A careful consideration of the results obtained fails to provide any basis for the assumption that there is any difference in the oxidation rates of liquid lime-sulphur and solutions of dry lime-sulphur of the same calcium polysulphide concentration. The presence of sludge was found to have only a negligible effect on the oxidation rate of such solutions.

STEAR (J. R.). **A visual Method of comparing Toxicity of Contact Dusts.**—*J. Econ. Ent.*, xxv, no. 4, pp. 929–930, 1 pl. Geneva, N.Y., August 1932.

For testing the relative toxicity of contact dust insecticides, a cylindrical glass jar of about 3 U.S. gals. capacity is fitted with a thick pasteboard lid, hinged to the jar with adhesive tape on one side. On the other side of the jar a gum band, taped to the jar, fastens over a cork glued to the lid and holds it in position. A hole about $\frac{3}{4}$ inch in diameter is cut in the lid to admit the insecticide and fitted with a cork. In testing a dust a quantity is used sufficient to fill the jar with a heavy fog when puffed with a dust atomiser. Satisfactory results have been obtained with $\frac{1}{2}$ gm. The test insects are placed in the lower half of a petri dish just inside the jar, which rests on its side. After the dust is blown in, the jar is closed for 2 minutes to allow it to settle, after which the petri dish is removed and observations made at intervals of one minute until all the insects are moribund. Only 5–10 insects are used in each test, tests being repeated several times.

It was observed in the course of these tests that the insects in moving about in the dish recorded their movements in the film of dust. In the case of an ineffective dust the entire layer would be kicked up, whereas with the more effective dusts well defined tracks were left, which are shorter as the toxicity is higher. Since the amount of dust displacement is inversely proportional to the toxicity, it became apparent that the records left in the dust by the insects would be sufficient for comparison. By this means a considerable saving of time is effected, as a large number of treatments can be proceeded with rapidly, examination for effectiveness being carried out later when convenient. Species of Aphids that are heavy bodied and sluggish are unsuitable for this method, as they easily become overturned and are unable to right themselves, but *Macrosiphum* (*Illinoia*) *pisi*, Kalt., which is active and hard to kill, makes an excellent test insect. Flat-bottomed glass dishes were more suitable than petri dishes.

FELT (E. P.). **Privet Thrips,** *Dendrothrips ornatus* **Jabl.**—*J. Econ. Ent.*, xxv, no. 4, p. 930. Geneva, N.Y., August 1932.

Dendrothrips ornatus, Jabl., has been found in New York State Connecticut and Massachusetts. This introduced thrips, which in no case caused serious damage, is presumably somewhat generally distributed.

LEONARD (M. D.). **An early Quarantine in Puerto Rico.**—*J. Econ. Ent.*, xxv, no. 4, pp. 930–931. Geneva, N.Y., August 1932.

A translation is given of a Spanish decree of 10th August 1815 instituting a quarantine to prevent the entry into Porto Rico of *Atta insularis*, Guér. (Cuban leaf-cutting ant).

Britton (W. E.). **Injury by Japanese Weevil,** *Pseudocneorrhinus setosus* **Roelofs.**—*J. Econ. Ent.*, xxv, no. 4, p. 931. Geneva, N.Y., August 1932.

Specimens of *Pseudocneorrhinus setosus*, Roel., which was first collected in New Haven, Conn., in 1920 [*cf. R.A.E.*, A, xii, 421], were received from West Haven, Conn., on 8th June 1932. On a subsequent visit the weevils were found feeding on Japanese barberry, California privet, lilac, and new tips of hemlock [*Tsuga*], and had already caused considerable injury. Two hemlocks had been killed and removed. A privet hedge 50 ft. long and a row of Japanese barberry had been stripped. As the weevils appear to be apterous, they are not likely to spread quickly.

Blanchard (R. A.). **First Record of** *Hypera postica* **Gyll. in the San Joaquin Valley, California.**—*J. Econ. Ent.*, xxv, no. 4, p. 931. Geneva, N.Y., August 1932.

Since mid-May 1932 *Hypera variabilis*, Hbst. (*postica*, Gyll.) has been found on lucerne in five counties in the San Joaquin Valley, California. At a conference held to discuss the problem on 25th May, although it was considered inadvisable to attempt complete eradication of the weevil, its control was not thought to present any special difficulty.

Felt (E. P.). **Apple Leaf-curling Midge,** *Dasyneura mali* **Kieffer.**—*J. Econ. Ent.*, xxv, no. 4, p. 932. Geneva, N.Y., August 1932.

A midge, provisionally identified as *Dasyneura mali*, Kieff., was reported to be prevalent on apple in an orchard in Massachusetts in the latter part of June 1932. It had not caused serious damage, although it was known to have been present in 1929 and may have been brought into the country with French stock about 1912. Attacked foliage had the terminal leaves on some 4–5 inches of young growth rolled inwards, the tissues being somewhat thickened and showing a distinctly reddish-brown, somewhat mottled colouring. A number of larvae were found within the leaf rolls, and on 21st July eggs, young and full-grown larvae were also observed under conditions suggesting continuous breeding for at least 4 weeks. The height of breeding appeared to be 20th June.

Stear (J. R.). **Reduction of White Grub Injury by Bordeaux Mixture.** —*J. Econ. Ent.*, xxv, no. 4, p. 932. Geneva, N.Y., August 1932.

Injury caused by Lamellicorn larvae to potatoes in Pennsylvania in 1930 amounted to 7–19·1 per cent. in plots sprayed with Bordeaux mixture (4–4–50) with the addition of 2 lb. lead arsenate to 50 U.S. gals., as compared with 11·5–41 per cent. in plots sprayed with lead arsenate alone and 10–43·3 per cent. in unsprayed plots. Further observations made on sprayed and unsprayed potatoes in 1931, when very little grub injury occurred, showed no injury in 250 potatoes from a Bordeaux sprayed plot, as compared with 4 injured potatoes among 250 from an unsprayed plot.

Snapp (O. I.) & Thomson (J. R.). **Disposition of Peach Drops infested with** *Conotrachelus nenuphar* **Larvae by Submergence in Water.**—*J. Econ. Ent.*, xxv, no. 4, p. 933, 2 refs. Geneva, N.Y., August 1932.

As burying is not a safe method of disposing of fallen peaches infested with *Conotrachelus nenuphar*, Hbst. [*R.A.E.*, A, xx, 429], an experiment was conducted during 1931 to determine whether submergence in water renders such fruit harmless. One bushel of infested peaches was placed in each of 7 burlap bags on 11th May and completely submerged in a flowing stream. Inspection at intervals showed that submergence for 28 days, at the end of which 98·3 per cent. of the larvae were drowned, was required to render the fruit harmless. After 18 days submergence only 48·3 per cent. of the larvae were dead. Although all appeared lifeless when removed from submerged fruit, the living ones revived within 30 minutes. Dumping loose peaches in a stream is therefore not considered a safe method of disposal on account of the possibility of the larvae escaping from those that float and come to rest on the bank when the water recedes.

Flanders (S. E.). **Temperature as a Measure of an Insect Population.**—*J. Econ. Ent.*, xxv, no. 4, p. 934. Geneva, N.Y., August 1932.

Reference is made to observations by the author and other workers on the heating of grain caused by the presence of insects, which is known as the "heat of infestation." This heating of grain is an important factor in the mass production of *Sitotroga cerealella*, Ol. [*R.A.E.*, A, xix, 96]. When infested grain is fumigated, the heat of infestation disappears, proving that it is a concomitant of the insect population. The heat of infestation may be due to the direct transference of the body heat of the insects to the grain, or to the heat produced by mandibular friction in eating. Whatever the method by which it is built up, it is at least a rough means of comparing grain insect populations when the air temperatures surrounding the containers are the same.

Leonard (M. D.). **Thrips Injury to** *Citrus* **and Rose in Puerto Rico.**—*J. Econ. Ent.*, xxv, no. 4, pp. 934–935. Geneva, N.Y., August 1932.

During the past 2½ years it has been observed that a moderate percentage of grapefruits and oranges in the packing houses of the principal citrus-growing sections of Porto Rico were marked with typical thrips scars. The thrips, which have been observed in greater or less numbers in the blossoms throughout the citrus belt, have now been identified as *Frankliniella insularis*, Frankl., and *F. difficilis*, Hood, the latter being reported apparently for the first time from Porto Rico. Injury to roses by *F. insularis* was reported on 1st June 1932 from Vieques Island, where great damage was done on five different properties. The infested buds fail to open or the flowers are spoiled, the withered ones being full of thrips, especially at the base of the petals. *Canna* blooms were also attacked, although they suffered less damage.

RITCHER (P. O.). **Hibernation of the Striped Cucumber Beetle, *Diabrotica vittata* (Fab.), and Records of Spring Food Plants.**—*J. Econ. Ent.*, xxv, no. 4, pp. 935–936. Geneva, N.Y., August 1932.

Adults of *Diabrotica melanocephala*, F. (*vittata*, F.) were found in Illinois during the winter and spring of 1931–32, hibernating in a woodland of about 60 acres. The beetles were on the surface of the soil under heavy leaf covering, under loose bark, and in other sheltered places, sometimes at distances of up to 120 yds. from the edge of the woods. On 20th April at a temperature of 72°F., they were seen out of hibernation for the first time. After this they were observed in numbers feeding on the leaves and blossoms of a variety of plants, at first in the woodlands and soon after the beginning of May along streams and bottom lands. Pairing was noticed on 4th May in the woodland, and on 20th May the beetles were first found on cultivated cucurbits, transplanted cucumbers being attacked by large numbers.

WHITCOMB (W. D.). **The Relation of Temperature to the Activity and Control of the Plum Curculio in Apples.**—*Bull. Massachusetts Agric. Expt. Sta.*, no. 285, 16 pp., 5 figs., 9 refs. Amherst, Mass., June 1932.

A detailed account is given of experiments in Massachusetts against *Conotrachelus nenuphar*, Hbst., on apple, the results of some of which have already been noticed [*R.A.E.*, A, xx, 405]. Although in the cage tests fish-oil did not materially increase the effectiveness of the lead arsenate spray, its use is recommended in the field in view of its adhesive and spreading qualities. The addition of 2 U.S. gals concentrated lime-sulphur solution and 10 lb. chemical hydrated lime to 100 U.S. gals. of the lead arsenate and fish-oil spray decreased the rapidity of its effect at 55 and 65°F., indicating some repellent action under these conditions. At 75 and 85°F., however, this mixture was more effective than lead arsenate and fish-oil alone. The application of insecticides should be timed according to the temperature, since the latter plays an important part in influencing the activity of the weevils. After the petals have fallen, a spray of 4–5 lb. lead arsenate to 100 U.S. gals. water, preferably with the addition of 1 U.S. pint fish oil or linseed oil, should be applied during the first period of warm weather when the maximum temperature is 75°F. or higher and is likely to continue so for 2 or more successive days. Except during severe infestations a sulphur-lead arsenate dust (85 : 15) can be substituted for the spray. When there are two distinct periods of high temperature within 15 days after the proper time for the calyx spray, the insecticide should be applied in each period. If the addition of a fungicide is desired, liquid lime-sulphur or a similar material can be added to the spray mixture without danger of greatly decreasing its effectiveness.

HAEUSSLER (G. J.). *Macrocentrus ancylivorus* **Roh., an important Parasite of the Oriental Fruit Moth.**—*J. Agric. Res.*, xlv, no. 2, pp. 79–100, 12 figs., 8 refs. Washington, D.C., 15th July 1932.

The following is taken from the author's summary of the results of investigations carried out in 1926–29 : *Macrocentrus ancylivora*, Rohw., is an important parasite of *Cydia* (*Grapholitha*) *molesta*, Busck (oriental fruit moth) in the environs of Riverton, New Jersey [*cf. R.A.E.*, A,

xviii, 163, etc.]. A greater percentage of females than males is produced when larvae of either *C. molesta* or *Ancylis comptana*, Froehl., act as the host of *M. ancylivora* in the field. This, however, does not always occur in the laboratory. Adults of both sexes confined together in cages lived on an average for 6·7 days, and unfertilised females and males confined separately for 17·9 and 10·3 days respectively. Oviposition is only possible when the larva of the host is in a position in which it cannot escape the ovipositor of the female. The most favourable position for attack seems to be when the larva is feeding within a peach twig or a thin slice of apple, or is enclosed in a light feeding web preparatory to entering a twig. Superparasitism occurs, but only one parasite larva survives. In the field, larvae of the earlier broods feeding in peach twigs are chiefly attacked. As many as 40 offspring have been produced by a single female under insectary conditions. The transforming parasite larva emerges from the host, on an average, 3 days after the latter would normally have pupated, and feeds on it for 12 to 18 hours. The hibernating one emerges from the host in the spring and requires an average of 2 days for feeding. The combined prepupal and pupal period averages 15·2 days for transforming parasites and 38·5 for overwintering ones. The average life-cycles of transforming and wintering forms of *Macrocentrus* are respectively 5·1 and 31 days shorter than those of the corresponding forms of *Cydia*. In outdoor cages the spring emergence of the moths occurs considerably earlier than that of the parasites. During late summer and early autumn there is a period during which eggs deposited by *Macrocentrus* and *Cydia* may produce either transforming or wintering progeny. There were 5 generations of the parasite in the area under review in 1927 and in 1928. The parasite hibernates as a first instar larva in the full-grown overwintering larva of the moth. Many parasite cocoons that are constructed late in the autumn and in the spring fail to produce adults.

Watson (J. R.). [**Report of the Department of**] **Entomology.**—*45th Ann. Rep. Florida Agric. Expt. Sta. 1930–31*, pp. 70–80. Gainesville, Fla. [1932.]

In the course of work against various pests in Florida during the year ending 30th June 1931, *Cryptolaemus montrouzieri*, Muls., was introduced from California in November and reared for the control of mealybugs on *Citrus* and bulbs. Experiments showed that the adults and larvae will feed on Aphids, the cottony cushion scale [*Icerya purchasi*, Mask.] and practically all species of mealybug found in Florida. The life-cycle occupied 30 days in May and June, and by 30th June more than 40 colonies had been liberated in the citrus-growing area. A general survey showed *Nezara viridula*, L., and *Leptoglossus phyllopus*, L., to be the most numerous of the plant bugs on *Citrus* and market garden crops. *Citrus* groves in which *Crotalaria* followed cowpeas as a cover crop suffered considerable damage in cases in which the cover crop had not been cut properly. The bugs, particularly *L. phyllopus*, were numerous on thistles in the early spring and may be found there until the seed has ripened.

The general infestation of *Aphis spiraecola*, Patch, on *Citrus* was light, though predators did not become numerous until late spring; *Syrphus wiedemanni*, Johns., and *Olla abdominalis*, Say, var. were more

abundant than usual, but *Baccha clavata*, Wied., and *Cycloneda sanguinea immaculata*, F., were comparatively scarce. A combination of lime-sulphur (1 : 40), ½ per cent. penetrol and nicotine sulphate (1 : 3,000) gave 99 per cent. mortality without injury to the foliage. The great importance of the winter control measures to prevent general infestation in spring was again demonstrated [*cf. R.A.E.*, A, xix, 267].

Eighty thousand individuals of *Trichogramma minutum*, Riley, were liberated against the pecan case-bearers, *Acrobasis* spp. The liberations took place too late to be of much effect against the eggs of the nut case-bearer, but recoveries have been made from those of leaf case-bearers. *Enarmonia* (*Laspeyresia*) *caryana*, Fitch (shuckworm), can be controlled by ploughing under the husks of pecan nuts after the majority of larvae have pupated, generally between 1st and 15th March. The most satisfactory method, however, is to gather the nuts on sheets and to pile the husks, which should be burnt when sufficiently dry. Infestations of 65·9 and 91·7 per cent. of the nuts were found at harvest in two areas. *Melanocallis* (*Myzocallis*) *fumipennellus*, Fitch (black hickory aphis) is becoming of increasing importance as a pest of pecan. It evidently injects a toxic substance into the leaves, which become discoloured and eventually fall. Preference is shown for varieties with dense foliage, and the shady portions of the tree are usually most heavily infested. *Mineola* (*Acrobasis*) *vaccinii*, Riley (blueberry fruit-worm) causes considerable damage to the blueberry crop in some areas. It has one brood annually and hibernates as a pupa in a case of sand and silk underneath the leaves on the ground. Cultural methods of control and the destruction of the pupae are advised. During work on the melon aphis [*Aphis gossypii*, Glov.], it was observed that the Aphids reproduced throughout the winter on *Eupatorium petaloideum* in a rather low-lying field where frost must have occurred on a few occasions. A 2 per cent. dust of 50 per cent. free nicotine with lime as a carrier gave good commercial control on water-melons in the experimental field. A light tin funnel was fastened on the end of the dusting machine and used while the plants were small, making work possible regardless of wind.

Noble (W. B.). **Sod Webworms and their Control.**—*Bull. U. S. Golf Ass. Green Sect.*, xii, no. 1, pp. 14–17, 5 figs. 1932. (Abstract in *Expt. Sta. Rec.*, lxvii, no. 4, p. 435. Washington, D.C., October 1932.)

Kerosene emulsion offers the most practical control from the standpoint of cost and effectiveness against *Crambus* spp. in putting greens and lawns. Pyrethrum extracts are rather more costly but equally efficient.

Notice of Lifting of the European Corn Borer Quarantine.—*U. S. Dept. Agric., P.Q.C.A.*, 1 p. Washington, D.C., 12th July 1932.

In view of the inadequacy of Federal funds, Quarantine no. 43, which was established to prevent the spread of the European corn borer [*Pyrausta nubilalis*, Hb.] within the United States, with its amendments and revisions [*R.A.E.*, A, viii, 517 ; xvi, 20, etc.], has been revoked as from 15th July 1932.

Streeter (L. R.) & Pearce (G. W.). **Reactions involved in the use of Hydrates in Lead Arsenate Sprays.**—*Indust. Engng. Chem.*, xxiii, no. 10, pp. 1140–1144, 3 graphs, 11 refs. Easton, Pa., October 1931.

The degree of arsenical injury to foliage has been found to be proportional to the amount of water-soluble arsenic present or formed in the spray mixture, and the use of hydrated lime with acid lead arsenate to suppress water-soluble arsenic has become an accepted practice. In the chemistry of the spray tank this practice is fundamentally sound, but little is known of the ultimate outcome of such a combination when applied as a spray or dust. As carbon dioxide is given off by foliage and is always present in the surrounding atmosphere, a critical study was undertaken by the authors on the reactions between acid lead arsenate, calcium hydroxide, carbon dioxide and calcium carbonate; and as the question has recently arisen as to whether magnesium hydroxide could be substituted for calcium hydroxide, the reactions between magnesium hydroxide, magnesium carbonates and acid lead arsenate were also investigated.

It has been shown that a small amount of calcium hydroxide will increase the amount of arsenic in solution, but that an excess will decrease it to a negligible quantity. When acid lead arsenate reacts with small amounts of calcium hydroxide to form water-soluble arsenic, the ratio of arsenic to calcium found in solution agrees closely with the ratio of these substances in calcium acid arsenate ($CaHAsO_4$). Small amounts of magnesium hydroxide react with acid lead arsenate to form larger quantities of soluble arsenic than are found when calcium hydroxide is used. Calcium carbonate and magnesium carbonates react with acid lead arsenate to form soluble arsenic, but the latter produce more than the former. It is concluded that calcium hydroxide is superior to magnesium hydroxide as a corrective for spray injury.

The reaction between calcium carbonate and acid lead arsenate is suppressed in the presence of high concentrations of carbon dioxide. Although the concentration of carbonic acid present at a leaf surface is unknown, it seems safe to assume that under normal atmospheric conditions the amount in the moisture surrounding foliage will probably not suppress the production of soluble arsenic by these two substances. It is concluded that absolute protection from arsenical injury cannot be expected until a substitute for hydroxides is found that does not become involved in so many complicated reactions. The use of calcium hydroxide is justified by the fact that, in general, less foliage injury occurs when this substance is added to arsenical sprays. Injury frequently follows the use of these sprays when they contain a large excess of hydroxide, probably owing to the reaction between acid lead arsenate and the carbonates formed by the carbonation of the excess hydroxide or between acid lead arsenate and a trace of calcium hydroxide.

Smyth (H. F.) & Smyth, jr. (H. F.). **Relative Toxicity of some Fluorine and Arsenical Insecticides.**—*Indust. Engng. Chem.*, xxiv, no. 2, pp. 229–232, 1 fig., 29 refs. Easton, Pa., February 1932

It has been suggested that much of the danger of spray residue on fruit might be avoided by using fluorine compounds as a substitute for

arsenical insecticides, as various workers have shown the former to be much less toxic to man. The problem studied was the acute toxicity, or single dose causing death, but as it is almost inconceivable that any person could eat sufficient sprayed fruit at one time to become acutely poisoned, information is really required on the chronic toxicity, or dose, that will cause injury when repeated daily for a considerable period of time. To determine this, the authors undertook experiments with rats fed for 16 weeks on food mixed with measured amounts of cryolite [sodium fluoaluminate], barium fluosilicate or lead arsenate, using these materials as representative of fluorine and arsenical insecticides in general. From the effects on behaviour, appetite, fecundity, growth, tooth development and pathology of the organs, it is concluded that several times as much of a fluorine compound is needed to produce the same chronic toxic effect as a given quantity of arsenical, and that the use of fluorine insecticides would therefore give a much wider margin of safety.

DeGryse (J. J.). **Notes on the early Stages of the European Pine Shoot Moth.**—*Canad. Ent.*, lxiv, no. 8, pp. 169–173, 10 figs. Orillia, Ont., August 1932.

During recent years the European pine-shoot moth [*Rhyacionia buoliana*, Schiff.], the egg and first and second instar larvae of which are briefly described, has been causing widespread damage to certain pine plantations in Canada and the United States [*cf. R.A.E.*, A, xix, 221], where it cannot be controlled by the method usually employed on nursery stock of cutting out the infested buds. Investigations on its life-history were therefore carried out in Ontario in 1932 with a view to finding other measures. The results show that the eggs are laid singly or in groups of 2–12, usually on or near the basal third of the new shoots, at some distance from the buds, and sometimes on the needles of the previous year's growth. The larvae hatch in 10–18 days according to the time of the year and wander about the needles, sometimes for 2–3 hours. They then construct silken tubes between the lower part of the sheath and the stem of the shoot or nearest bud, after which they bore through the sheath into the needles. The entire first instar is passed in the needles and lasts 5–7 days. The injured needles become loosened, gradually turn brown and often fall out of the sheath. Larvae of the second instar continue feeding on the needles for a time, but then construct cell-like webs, either between two or more buds or between the buds and adjoining needles, after which they bore into the buds. When these are small, they are destroyed in a short time, and the larva migrates to an adjoining bud in the same cluster or more rarely to one on another shoot. Two or more larvae may be found feeding on the same cluster, but never more than one in a bud. The length of the second instar has not been determined. It was found that on heavily infested trees quite a number of the larvae continued to feed on the needles even in the third instar.

As the first instar larvae do not feed on the buds, as had been previously supposed, and those of the second usually enter them at a point not protected by the first web, poison sprays might afford an additional means of control, provided that they could be made to adhere for a sufficiently long period to the needles and buds.

Walley (G. S.). **Host Records and new Species of Canadian Hymenoptera.**—*Canad. Ent.*, lxiv, no. 8, pp. 181–189. Orillia, Ont., August 1932.

Among the new species described are *Microbracon bembeciae*, parasitising *Pennisetia* (*Bembecia*) *marginata*, Harr., in British Columbia, and the Torymid, *Megastigmus specularis*, reared from the seeds of *Abies balsamea* in New Brunswick and Nova Scotia.

Hopping (G. R.). **Studies in the Life History of** *Trachykele blondeli* **Marseul.**—*Canad. Ent.*, lxiv, no. 8, pp. 189–191, 5 refs. Orillia, Ont., August 1932.

In connection with studies on the life-history of *Trachykele blondeli*, Mars., in British Columbia during 1926–30 [*cf. R.A.E.*, A, xvii, 230], trees or logs of *Thuja plicata* were enclosed in cheese-cloth cages before 30th April 1926 for the purpose of determining the length of the larval stage of this Buprestid. The adults that emerged in the cages numbered 5 in 1926, 3 in 1927, 13 in 1928, 3 in 1929, and 1 in 1930. As it is improbable that any egg-laying could have taken place subsequent to caging, the eggs that gave rise to these adults must have been deposited at least as far back as the spring of 1925. Since the egg and pupal stages occupy about a month and the adults after transforming in the autumn remain in the pupal cells until the spring (nine months), the larval period of the individuals that emerged in 1929 is estimated to have lasted at least 3 years and 2 months. Observations tend to indicate that *T. blondeli* is controlled to a certain extent by the Evaniid, *Odontaulacus editus*, Cress.; in 1928 two individuals of this parasite were taken in one of the cages.

Edwards (W. H.). **Importation into Jamaica of a Parasite** (*Eretmocerus serius*, **Silv.**) **of the Citrus Black Fly** (*Aleurocanthus woglumi*, **Ash.**).—*Ent. Bull. Dept. Sci. Agric. Jamaica*, no. 6, 12 pp., 7 refs. Kingston, 1932.

This is the text of a lecture delivered to citrus planters to explain the principles of biological control of insect pests, in view of the recent introduction into Jamaica of *Eretmocerus serius*, Silv., a parasite of *Aleurocanthus woglumi*, Ashby (citrus black-fly) [*cf. R.A.E.*, A, xx, 512].

Greene (H. D.). **Some Pest Control Problems of the Argentine Fruit Grower.**—*Mon. Bull. Dept. Agric. California*, xxi, no. 4–6, pp. 258–268, 5 figs., 3 refs. Sacramento, Cal., 1932.

Lists are given of a number of insects and fungi attacking *Citrus* and general fruit crops in Argentina, and the status and control of some of the more important ones are briefly discussed, including *Iridomyrmex humilis*, Mayr, *Cydia pomonella*, L. (codling moth) and *Eriosoma lanigerum*, Hausm. (woolly apple aphis). Red spiders, of which *Bryobia praetiosa*, Koch (*pratensis*, Garm.) is the most important, are becoming increasingly troublesome on apple. The application of a spray of winter oil or lime-sulphur in August before the buds open has given satisfactory control in the past, but it now appears that a summer spray, probably an oil combined with one of the lead arsenate cover sprays, will be necessary in seasons of severe infestation. One of the most

widespread orchard pests is *Aspidiotus perniciosus*, Comst. (San José scale), which causes rapid deterioration of trees left untreated for several years. This Coccid is comparatively easy to control, however, with a winter spray of oil (4–6 per cent.) or lime-sulphur. The use of oil in early summer sprays is recommended against the young migratory larvae in serious infestations.

The Psychid, *Oeceticus kirbyi*, Guild., is widely distributed and attacks many bushes and trees, particularly tamarisk and poplar growing as windbreaks around orchards, and native willows. From these the young larvae migrate or are blown by the wind into the orchards, where they feed on and disfigure the fruit. Control is rendered difficult by the continuous overlapping of the broods and the fact that throughout most of their lives the insects are protected within an impervious bag composed of closely woven web and small sticks or leaves. Damage is caused from late September to early February, and it is necessary to keep the fruit constantly protected by lead arsenate sprays. The females and eggs, which are laid within the bags, can be destroyed by pruning and burning all infested branches during the dormant period.

Husain (M. A.) & Khan (Abdul Wahid). **Food-plants of** *Dialeurodes citri*, **Ashmead (Aleyrodidae). Is** *Jasminum* **one of them ?**—*Ind. J. Agric. Sci.*, ii, pt. 3, pp. 242–253, 1 pl., 13 refs. Calcutta, June 1932.

In spite of careful investigations in the Punjab of possible food-plants of *Dialeurodes citri*, R. & H., including all types of vegetation in and near citrus orchards, this Aleurodid was not found on any plant other than *Citrus*. Unsuccessful attempts were made to breed it on pomegranate (*Punica granatum*), guava (*Psidium guayava*), pear (*Pyrus communis*) and other trees. On no occasion was it found on jasmin (*Jasminum*), from which it has frequently been recorded in the literature [*cf. R.A.E.*, A, iv, 439], and adults refused to oviposit on *J. sambac* in the laboratory. Observations and experiments showed that the whitefly attacking *Jasminum* and also *Hiptage* is in reality *Dialeurodes kirkaldyi*, Kot.; moreover, specimens labelled *D. citri* on *Jasminum* from other parts of India proved also to be *D. kirkaldyi*. The characters distinguishing the two species are shown.

A list is given of all the plants other than *Citrus* on which *D. citri* has been recorded in various parts of the world, with references to the papers concerned. As shown by this work, together with that of others, which is briefly reviewed, many of the records are doubtful, and some certainly erroneous.

Hutson (J. C.). **Some Insect Pests of Tea in Ceylon. The Tea Tortrix (*Homona coffearia* Nietn.).**—*Trop. Agriculturist*, lxxix, no. 2, pp. 75–85, 1 pl., 15 refs. Peradeniya, August 1932.

This account of *Homona coffearia*, Nietn. (tea tortrix) in Ceylon is largely taken from the literature [*R.A.E.*, A, xv, 218, etc.]. Descriptions of the stages are given, and the bionomics discussed.

Holland (T. H.). **The Cultivation of Derris for the Manufacture of Insecticides.**—*Trop. Agriculturist*, lxxix, no. 2, pp. 126–132, 2 refs. Peradeniya, August 1932.

The interplanting of *Derris* with rubber trees that are old or not being tapped is suggested. Notes are given on some species of *Derris* that

are indigenous to Ceylon or have been introduced from Malaya and their insecticidal value, the general conditions suitable for growing the plants, the optimum time for harvesting, the yield that may be expected, and the method of drying and packing the roots for the market.

ONOE (T.) & IWASAKI (S.). **Fumigation Experiments with the Rice Borer, I.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 3, pp. 146–147. Tokyo, July 1932.

In fumigation experiments, hibernating larvae of *Chilo simplex*, Butl., in rice straws were killed by chloropicrin in 24 hours, carbon bisulphide and hydrocyanic acid gas being less effective.

KAMIYA (K.). **Hymenopterous Parasites of *Dendrolimus spectabilis* Butl. and the Interrelation of its Enemies.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 3, pp. 148–149. Tokyo, July 1932.

The following parasitic Hymenoptera are recorded from *Dendrolimus spectabilis*, Butl., the first three attacking the eggs: *Anastatus gastropachae*, Ashm., *A. albitarsis*, Ashm., *Trichogramma* sp., *Apanteles japonicus*, Ashm., *Phanomerus spectabilis*, Mats., *Rhythmonotus takagii*, Mats., *Brachymeria obscurata*, Wlk., *Monodontomerus spectabilis*, Mats., *Pteromalus dendrolimi*, Mats., *Theronia atalantae*, Poda, *Amblyteles* (*Spilichneumon*) *oratorius*, F., *Pimpla disparis*, Vier., *P. pluto*, Ashm., *P.* (*Exeristesoides*) *spectabilis*, Mats., *P.* (*Itoplectis*) *attaci*, Haberm., and *Pimpla* (*Epiurus*) sp. Some of these, however, may be hyperparasites.

REICHERT (A.). **Rosenschädlinge.** [Rose Pests.]—*Die kranke Pflanze*, ix, nos. 4–5, 8, pp. 44–47, 75–78, 2 pls. Dresden, 1932.

In Saxony, *Dasyneura* (*Dichelomyia*) *rosarum*, Hardy, oviposits on the unopened leaves of roses, which then fail to unfold, the larvae living within. There appear to be several generations a year, hibernation occurring in the larval stage. Another Cecidomyiid, *Thomasiniana* (*Clinodiplosis*) *oculiperda*, Rübs., is more harmful, as it oviposits at the point where budding has been done, and feeding of the larvae prevents the union of the bud with the stock. The wound made in budding can be protected with a thick paste of clay. Adults of the Tineid, *Cheimophila* (*Dasystoma*) *salicella*, Hb., are on the wing about the end of March, and the larvae appear in the second half of May. They spin the leaves into shelters, in which pupation takes place, the pupa falling to the ground with the leaf. The larvae of another Tineid, *Incurvaria morosa*, Zell., which appears in May, attack the flower-buds and probably hibernate in débris on the ground. In spring they re-appear and feed on the leaf-buds, in which they pupate.

SCHWERDTFEGER (F.). **Vergleichende Untersuchungen über die Wirkung einiger Kontaktgifte auf Forstschädlinge.** [Comparative Investigations on the Action of some Contact Poisons on Forest Pests.]—*Z. PflKrankh.*, xlii, no. 9, pp. 426–440, 7 figs., 14 refs. Stuttgart, September 1932.

This paper describes laboratory tests of the action of six German proprietary contact insecticides on larvae of *Dendrolimus pini*, L.,

Lymantria monacha, L., and *Panolis flammea*, Schiff. Two dusts and a spray were preparations of derris and proved more effective than the other three, these being dusts in which the poison is not stated.

LEHMANN (H.). **Wanzen (Hemiptera-Heteroptera) als Obstbaumschädlinge.** [Bugs as Fruit-tree Pests.]—*Z. PflKrankh.*, xlii, no. 9, pp. 440–451, 4 figs., 12 refs. Stuttgart, September 1932.

A brief survey of European work on Capsid pests of fruit trees is given, with a summary of investigations in England on *Plesiocoris rugicollis*, Fall. Up to now 13 species of Heteroptera have been recorded in orchards in Germany, but there are probably more, as Zschokke collected a larger number in Switzerland [*R.A.E.*, A, x, 583]. Of the German species, *Orthotylus marginalis*, Reut., *Psallus ambiguus*, Fall., and *Atractotomus mali*, Meyer, are useful predators. *Dolycoris baccarum*, L., *Syromastes marginatus*, L., *Calocoris norvegicus*, Gmel. (*bipunctatus*, F.) and *Lygus kalmi*, L., are harmless or nearly so, either because they are not abundant or because they do not make toxic punctures. *Pentatoma* (*Tropicoris*) *rufipes*, L., is a well-known pest of apples, pears and cherries in the Werder district. The Tingid, *Stephanitis pyri*, F., is confined to the warm Rhine valley. Of the more injurious Capsids, *Plesiocoris rugicollis* is usually too seldom found to be classed as a general pest. *Calocoris biclavatus*, H.-S., has occurred several times on pears, but *Lygus pabulinus*, L., may be regarded as the chief harmful species, though not enough is known of its biology to suggest control measures. Damage caused by it has been attributed to *L. pratensis*, L., but if the latter really hibernates in the adult stage, it may possibly be a pest of buds in spring.

REINBOTH (G.). **Die Pflanzenkrankheits-Bekämpfung in Ligurien.** [The Control of Plant Diseases and Pests in Liguria.]—*Z. PflKrankh.*, xlii, no. 9, pp. 468–470. Stuttgart, September 1932.

In Liguria the use of bait-sprays has reduced attack by the olive fly [*Dacus oleae*, Gmel.] from 45–70 per cent. in untreated localities to 6 per cent. *Aphelinus mali*, Hald., has been established against *Eriosoma lanigerum*, Hausm., and *Rodolia* (*Novius*) *cardinalis*, Muls., has been imported and distributed against Coccids.

MENOZZI (C.). **Il Pidocchio** (*Aphis rumicis* **L.**) **dannoso alla bietola da zucchero e la lotta contro di esso.** [*A. rumicis*, a Pest of Sugar-beet, and Measures against it.]—*Ind. saccarif. ital.*, xxv, no. 6, reprint 2 pp. Genoa, June 1932.

In Italy sugar-beet is infested by the Aphids, *Myzus persicae*, Sulz., and *Aphis rumicis*, L. The latter causes deformation of the leaves and encourages the growth of sooty fungus. The natural enemies observed in Central Italy include two Braconids of the genus *Aphidius*, two species of *Syrphus*, *Leucopis* sp., *Chrysopa* sp., and the Coccinellids, *Adalia bipunctata*, L., and *Coccinella septempunctata*, L., but as they become effective only after injury has been caused, a spray should be applied in late May or early June as soon as the winged Aphids have migrated to the beet from their primary food-plants. The formulae recommended are 2 gals. kerosene and 20 lbs. soap, or $\frac{1}{5}$ gal. 25 per cent. nicotine sulphate and 10 lb. soap, in 100 gals. water.

Plantesygdomme i Danmark 1931. [Plant Diseases and Pests in Denmark in 1931.]—*Tidsskr. Planteavl*, xxxviii, pp. 349–395, 1 fig., 2 graphs; also as *Overs. St. Plantepat. Forsøg*, no. 48. Copenhagen, 1932. (With a Summary in English.)

Pests occurring in Denmark in 1931 included, in addition to some recorded in the previous year [*R.A.E.*, A, xx, 144]: *Charaeas graminis*, L., which was very abundant on grasses in northern Jutland; *Psylliodes chrysocephala*, L., on swede and turnip seedlings; *Thrips angusticeps*, Uzel, on cabbage; *Blitophaga opaca*, L., on young beets, re-sowing being rendered necessary in many cases; *Contarinia pyrivora*, Riley, attacks by which on pear seem to be increasing, the trees being sprayed with nicotine without positive result; *Hoplocampa fulvicornis*, Panz., on plum; and *Byturus tomentosus*, F., on raspberries. Adults of *Otiorrhynchus sulcatus*, F., the larvae of which attack the roots of cyclamen, occurred on *Rhododendron*; the weevils were caught in large numbers in wood-flock placed around the plants.

PAPERS NOTICED BY TITLE ONLY.

OLDHAM (J. N.). **On the final larval Instar of** *Tipula paludosa*, **Meig., and** *Tipula lateralis*, **Meig.**—*Proc. Roy. Phys. Soc. Edinb.*, xxi, pt. 5, pp. 217–252, 32 figs., 21 refs. Edinburgh, 1929. [Recd. October 1932.]

MELLANBY (K.). **The Effect of atmospheric Humidity on the Metabolism of the fasting Mealworm** (*Tenebrio molitor* **L., Coleoptera).**—*Proc. Roy. Soc.*, (B) cxi, no. 772, pp. 376–390, 1 fig., 10 refs. London, 1st September 1932.

GOODEY (T.). **Further Observations on** *Tylenchinema oscinellae* **Goodey, 1930, a Nematode Parasite of the Frit-fly** [*Oscinella frit*, L., in Britain].—*J. Helminthol.*, ix, no. 3, pp. 157–174, 2 figs., 4 refs. London, July 1931. [*Cf. R.A.E.*, A, xviii, 567.]

MENOZZI (C.). **Lotta artificiale e naturale contro taluni insetti più dannosi alla barbabietola da zucchero in Italia.** [Artificial and natural Control in 1930 of some of the more injurious Insects of Sugar-beet in Italy.]—*Arch. zool. ital.*, xvi, no. 3–4, pp. 1090–1096, 1 ref. Padua, 1931. [*Cf. R.A.E.*, A, xix, 183, 461; xx, 537.]

CLAUS (J.). **Die Rindenwucherungen an ausländischen Tannen, verursacht durch die Tannenläuse** *Dreyfusia piceae* **Ratz. C. B. und** *Dreyfusia nüsslini* **C.B.** [Bark Deformations on exotic Species of *Abies* in Germany caused by *Chermes piceae* and *C. nüsslini*.]—*Die kranke Pflanze*, ix, no. 8, pp. 78–81, 1 fig., 6 refs. Dresden, 1932.

MORGENTHALER (O.). **Ein Jahrzehnt Milbenkrankheit der Honigbiene. Entdeckung, Erforschung und Bekämpfung eines Seuchen-Erregers.** [Ten Years' Work on Acarine Disease (*Acarapis woodi*) of the Honey-bee. The Discovery, Investigation and Control of the Causal Agent of a Disease. (A Review of the Literature.)]—*Z. angew. Ent.*, xix, no. 3, pp. 449–489, 11 figs., 3 pp. refs. Berlin, September 1932.

SCHMITT (N.). **Kultur- und Absatz der** *Derris elliptica* **Benth.** [The Cultivation and Supply of *D. elliptica*.]—*Tropenpflanzer*, xxxv, no. 9, pp. 375–380, 1 fig. Berlin, September 1932.

Uvarov (B. P.). **Bioclimatograph, an improved Method for analysing bioclimatic Relations of Insects.**—*Ecology*, xiii, no. 3, pp. 309–311, 1 fig., 3 refs. Brooklyn, N.Y., July 1932. [*Cf. R.A.E.*, A, xx, 548.]

Shull (A. F.). **Clonal Differences and Clonal Changes in the Aphid** *Macrosiphum solanifolii* [*gei*, Koch].—*Amer. Nat.*, lxvi, no. 706, pp. 385–419, 7 refs. New York, 1932.

Creel (C. W.) & Rockwood (L. P.). **The Control of the Clover-flower Midge** [*Dasyneura leguminicola*, Lint.].—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 971 (revd.), 12 pp., 6 figs. Washington, D.C., February 1932. [*Cf. R.A.E.*, A, vii, 4.]

Tissot (A. N.). **Six new Aphids from Florida, with Description of the sexual Forms of another Species.**—*Florida Ent.*, xvi, no. 1, pp. 1–13, 1 pl. Gainesville, Fla., July 1932.

Thomson (J. R.). **Sex Differentiation of Adults of** *Conotrachelus nenuphar*.—*J. Econ. Ent.*, xxv, no. 4, pp. 807–810, 14 figs. Geneva, N.Y., August 1932.

Eagleson (C. W.). **Permanent Preservation of biological Specimens in Gelatin.**—*J. Econ. Ent.*, xxv, no. 4, pp. 936–937, 1 ref. Geneva, N.Y., August 1932.

Kuwana (I.). **On the Scale Insects of the Genus** *Antonina* **in Japan.** [*In Japanese.*]—*Dobuts. Zasshi*, xliv, no. 524, pp. 213–220, 2 figs. Tokyo, June 1932. (With a Summary in English.)

Muramatsu (K.). **On** *Lecanium cerasorum* **Ckll., a Pest of Street Trees.** [*In Japanese.*]—*Kontyû*, vi, no. 2, pp. 74–79, 4 figs. Tokyo, July 1932.

Ladell (W. R. S.). **Telephone Cable Lead Covers. Preliminary Note on boring by the Carpenter Bee** [*Xylocopa* in Siam].—*Rec. Min. Comm. Commun.*, no. 40, 3 pp., 2 pls. Bangkok, April 1931. [Recd. October 1932.] [*Cf. R.A.E.*, A, xx, 115.]

Karam Singh [Lamba]. **On some new Rhynchota of the Family Aleyrodidae from Burma** [including ten new species].—*Rec. Ind. Mus.*, xxxiv, pt. 2, pp. 81–88, 4 pls., 8 refs. Calcutta, June 1932.

Ishii (T.). **Hymenopterous Parasites of Coccids and Aleurodids attacking** *Citrus* **in Japan.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 3, pp. 150–152. Tokyo, July 1932.

Mahdihassan (S.). **The Metamorphosis of the male Lac Insect.**—*Acta Soc. ent. Cech.*, xxviii, pt. 1–2, pp. 5–15, 16 figs., 6 refs. Prague, 1931. [Recd. October 1932.]

Betrem (J. G.). **Ambrosia kevers.** [The Coffee Twig Borers, *Xyleborus morigerus*, Bldf., and *X. morstatti*, Hag., in Java.]—*Handl. Zesde Ned.-Ind. natuurwet. Cong., Bandoeng (Java), 22–26 September 1931*, pp. 440–448, 1 fig. ? Batavia, 1931. [*Cf. R.A.E.*, A, xix, 568; xx, 567.] [Recd. September 1932.]

Kojima (T.). **Beiträge zur Kenntnis von** *Lyctus linearis* **Goeze.** [Contributions to the Knowledge of *L. linearis*.]—*Z. angew. Ent.*, xix, no. 3, pp. 325–356, 17 figs., 40 refs. Berlin, September 1932.

An account is given of investigations at Munich on the bionomics and control of *Lyctus linearis*, Goeze, with descriptions of the immature stages, alimentary canal of the larva and genitalia of both sexes.

Wood with pores slightly larger than the eggs is preferred for oviposition [*cf. R.A.E.*, A, xvi, 586], though chemical and physical factors are also concerned, heartwood being never attacked even in the case of a favourite timber such as oak. Ash and willow are also commonly infested, and timber of some other deciduous trees, a list of which is given, is sometimes attacked. Oviposition occurred at 12–28°C. [53·6–82·4°F.] and a relative humidity of 75–78 per cent.; the optimum appeared to lie between 17 and 23°C. [62·6–73·4°F]. In June the eggs hatched in 10 days or less. The larvae mine in the wood in a longitudinal direction, hibernating when half-grown. In heated rooms they pupated in January, and in April and May in unheated ones, in which the pupal period lasted 8–21 days. The peak of emergence occurred in mid-May at an average room-temperature of 20·3°C. [68·54°F.]. The life of the beetles averaged 20·7 days at 12–13°C. [53·6–55·4°F.], and 9 days at 27–28°C. [80·6–82·4°F.]

The natural enemies observed include the Clerids, *Tillus unifasciatus*, F., and *Monophylla terminata*, Say, the Braconid, *Eubadizon pallidipes*, Nees, and the Chalcidoid, *Perilampus micans*, Dalm. The two parasites have been found in timber in Bavaria and Jugoslavia and must be an important check on the Lyctid. The most reliable preventive measure is the removal of the sapwood [*cf.* xx, 510], but if it be necessary to retain the latter, the pores should be sealed with paint, etc., to prevent oviposition. A proprietary chlorinated hydrocarbon was found to destroy all larvae to a depth of 0·4 inch, the liquid being brushed on to the rough, sawn surface. Various measures advocated in the literature are discussed.

Blunck (H.). **Zur Kenntnis der Lebensgewohnheiten und der Metamorphose getreidebewohnender Halticinen.** [A Contribution to the Knowledge of the Life-history and Metamorphosis of Halticids infesting Cereals.]—*Z. angew. Ent.*, xix, no. 3, pp. 357–394, 14 figs., 4 pp. refs. Berlin, September 1932.

As very little is known of the Halticid beetles that infest grasses and cereals in Germany, it was sought to ascertain which species attack the latter crops, the course of their development, and the morphology of their larvae. Those suspected of injuring cereals belong to the genera *Crepidodera*, *Chaetocnema*, *Psylliodes* and *Phyllotreta*, and the literature on them is reviewed. The bulk of the paper (23 pages) is devoted to *Crepidodera ferruginea*, Scop. Its distribution in Europe and various parts of Germany is discussed. Feeding experiments with plants of many orders show that it prefers Gramineae, Papilionaceae, Compositae and Boraginaceae. Of 29 Gramineae offered, only 3 were rejected. Rye, wheat and barley proved the most attractive, oats less so. In Schleswig-Holstein the adults occur from mid-June to early September. Eggs are laid in the ground near the plants; those deposited in August and September hatch within a month. The larvae mine in the bases of the young stems and apparently leave the plants

to hibernate, but return to them in the spring, pupating in the ground in May.

Information regarding *Chaetocnema aridula*, Gyll., and *C. hortensis*, Geoff. (*aridella*, Payk.) is taken almost entirely from the literature. Both species infest wheat, barley, rye and oats. The morphology of the larva of *Phyllotreta vittula*, Redtb., which attacks cereals, especially wheat, and references to it in the literature are discussed at length, since it long remained unrecognised as a result of being described and figured by Lindeman in 1887 as the larva of a species of *Chaetocnema*. The morphological and biological characters differentiating the 4 species dealt with are summarised.

KLEIN (H. Z.). **Studien zur Oekologie und Epidemiologie der Kohlweisslinge. I. Der Einfluss der Temperatur und Luftfeuchtigkeit auf Entwicklung und Mortalität von *Pieris brassicae* L.** [Studies on the Ecology and Epidemiology of the Cabbage Whites. I. The Influence of Temperature and Air Humidity on the Development and Mortality of *P. brassicae*.]—*Z. angew. Ent.*, xix, no. 3, pp. 395–448, 10 figs., 27 refs. Berlin, September 1932.

This study was made at Tel-Aviv during 1926–31 to collect data for ecological and epidemiological investigations, and *Pieris brassicae*, L., was selected for it because its southern limit is in Palestine. The subjects dealt with comprise the duration of the stages of the butterfly, mortality among them, egg production, development in Palestine and in the entire region of distribution, and development potential.

The following is taken from the author's conclusions: The Blunck-Bodenheimer formula for accumulative warmth [*R.A.E.*, A, xiii, 389, etc.] enables the calculation and representation of the influence of temperature and air-humidity on development to be made easily and comprehensively, and the figures obtained agree with empirical data in Palestine and other countries. By means of the mortality diagram of Shelford and Bodenheimer, a clear picture may be obtained of the fatal zones of temperature and air-humidity. In most cases temperature dominates the rate of development of *P. brassicae*, humidity being of little significance, but both are important as regards the number of eggs and mortality among the stages, humidity being sometimes the decisive factor. The fatal zones for development result from temperatures above 26°C. [78·8°F.], when 100 per cent. mortality of the eggs occurs, and below 13°C. [55·4°F.] or humidity below 60 per cent., when no eggs are laid. In the coastal region of Palestine 7 generations a year are possible, 5 having been bred from early October to late July. Development was calculated on temperature data only, and the result compared with empirical data in the literature. The northern limit of *P. brassicae* is a region in which an average temperature of 15–16°C. [59–60·8°F.] is reached for at least 3 months, whereas the southern limit requires that in no month should an average of 26°C. be exceeded.

TRENKLE (—). **Ist der Apfelblütenstecher schädlich?** [Is the Apple Blossom Weevil harmful?]—*Anz. Schädlingsk.*, viii, no. 9, pp. 105–110. Berlin, September 1932.

The author disagrees with the criticisms [*R.A.E.*, A, xx, 342] of his conclusions that *Anthonomus pomorum*, L., is actually harmful in southern and western Germany [xix, 615]. Numerous instances are adduced of 80–100 per cent. destruction of the apple blossoms, a rate at which the attack is recognised as injurious by Aristov [xx, 233].

Furthermore, the criticisms have disregarded the fact that the damage done also includes the spring feeding of the hibernated adults, which destroy the styles and pollen vessels in the swelling buds [xiii, 61].

FRANSEN (J. J.). **De kleine Iepenspintkever** *Scolytus* (*Eccoptogaster*) *multistriatus* **Mrsh. als verbreider der Iepenziekte.** [The small Elm Beetle, *S. multistriatus*, as a Spreader of Dutch Elm Disease.] —*Tijdschr. Plantenziekt.*, xxxviii, no. 9, pp. 197–202, 2 figs., 2 pls., 18 refs. Wageningen, 1932.

Investigations at Wageningen in 1932 have shown that too little attention has been paid to the part played by *Scolytus multistriatus*, Mrsh., in spreading *Graphium ulmi*, the causal agent of Dutch elm disease [*R.A.E.*, A, xix, 499, etc.]. Whereas in 1931 *S. scolytus*, F., outnumbered *S. multistriatus* by 46 to 1, the proportion was about 3 to 1 in 1932. Elms that are coppiced appear more likely to be infected, because *S. multistriatus* prefers for maturation feeding the new, rapidly-growing shoots put forth by the stump, and the fungus develops quickly in such shoots.

DE FLUITER (H. J.). **Bijdrage tot de kennis der biologie en epidemiologie van de gewone dennenbladwesp,** *Pteronus* (*Lophyrus*) *pini* **(L.) in Nederland.** [A Contribution to the Biology and Epidemiology in Holland of the common Pine Sawfly, *Diprion pini*.]—*Tijdschr. Plantenziekt.*, xxxviii, no. 7–8, pp. 125–196, 8 figs., 5 graphs, 3 pls., 103 refs. Wageningen, 1932.

A detailed account is given of observations in Holland on the bionomics and natural enemies of the pine sawfly, *Diprion pini*, L., made in consequence of outbreaks that occurred in 1929 and 1930. The following is largely taken from the author's summary: One generation of adults appears in May and June, and the other in July and August. Many cocoons of both generations, however, do not give rise to adults in the normal time, instances of diapause lasting 8–9 and $17\frac{1}{2}$ and 32 months being observed. The adults fed readily on sugar-water and lived for a maximum period of 11 days. The outbreaks were of short duration and ended suddenly, and this led to observations on natural enemies made in the field. The cocoons were destroyed by mice and squirrels, and the larvae by tits. The eggs were parasitised by a Eulophid, *Closterocerus* sp., and the larvae by the Ichneumonids, *Ichneumon nigritarius*, Grav., *Microcryptus subguttatus*, Grav., *M. basizonus*, Grav., *M. sericans*, Grav., *Spilocryptus nubeculatus*, Grav., *Leptocryptus claviger*, Taschb., *Pimpla pfankuchi*, Brauns, *Exenterus marginatorius*, F., *E. oriolus*, Htg., and *Holocremnus clandestinus*, Holmgr., the Eulophid, *Microplectron fuscipennis*, Zett., and the Tachinids, *Sturmia inconspicua*, Mg., and *Diplostichus janithrix*, Htg. (*tenthredinum*, B. & B.). All stages of the sawfly are described.

The author discusses the nomenclature of the genus *Diprion* (*Lophyrus*) and considers that the correct name for it is *Pteronus*.

OZOLS (E.). **Observations on Pests of cultivated Plants during the Years 1930 and 1931.** [*In Lettish.*]—*Acta Inst. Def. Plant. latviens.*, ii, pp. 52–65, 2 graphs, 2 maps. Riga, 1932. (With a Summary in English.)

Of the pests that occurred on various cultivated plants in Latvia in 1930 and 1931, the Psyllid, *Trioza viridula*, Zett., on carrots, was the

most important. Others that caused serious injury included *Cydia* (*Laspeyresia*) *nigricana*, Steph., on peas; *C.* (*L.*) *pomonella*, L., on apples; *Phorbia* (*Chortophila*) *brassicae*, Bch., on cabbage; the Tineid, *Incurvaria capitella*, Cl., on black currant; and the sawfly, *Athalia colibri*, Chr., an outbreak of which occurred for the first time in Latvia in 1931, on turnip, kale, cauliflower and horse-radish. *Cheimatobia* (*Operophthera*) *brumata*, L., has steadily increased in numbers on apple in the course of the last three years. The Noctuid, *Trachea basilinea*, F., was abundant in 1930 on grass (*Festuca*), and was parasitised by the Ichneumonid, *Meniscus catenator*, Panz. *Phaedon cochleariae*, F., and *Phyllotreta nemorum*, L., caused considerable damage to turnip and kale, though the former was parasitised by *Microbracon* (*Bracon*) *guttiger*, Wesm. The specimens of this Braconid obtained differed in certain characters, which are indicated, from the typical form as originally described.

Ozols (E.). **On meteorological Factors accompanying the Outbreaks of *Phaedon cochleariae* F. and *Phyllotreta nemorum* L.** [*In Lettish.*]—*Acta Inst. Def. Plant. latviens.*, ii, pp. 66–71, 1 graph, 10 refs. Riga, 1932. (With a Summary in English.)

Since *Phaedon cochleariae*, F., and *Phyllotreta nemorum*, L., have practically no natural enemies, abiotic factors probably play an important part in the occurrence and control of outbreaks of these pests on crucifers. Observations on their occurrence in a locality in western Latvia during 1912–1931 and an analysis of the meteorological conditions in the same years showed that outbreaks of the two species are governed by more or less the same meteorological factors, the weather in May, and especially in June, being decisive. Optimum conditions for an outbreak are afforded by a mean temperature in June of 14·5–16·5°C. [58·1–61·7°F.] combined with a precipitation of 0·8–2·75 ins.

Zirnits (J.). **Overwintering of Aphid Eggs in 1928–29.** [*In Lettish.*] —*Acta Inst. Def. Plant. latviens.*, ii, pp. 72–76, Riga, 1932. (With a Summary in English.)

With a view to determining the effect of frost on Aphid eggs in Latvia, eggs of 38 different species that had passed the very severe winter of 1928–29 in the open under various conditions were allowed to hatch in the laboratory. The minimum temperature observed in February was —34°C. [—29·2°F.], and in different localities many fruit trees and shrubs were killed by the cold. It was found, however, that the majority of the eggs had not been affected, a high rate of mortality being observed only among those of *Aphis idaei*, v.d. G., *A. viburni*, Scop., *Periphyllus* (*Chaitophorinella*) *aceris*, Koch, and *Neochmosis* (*Lachnus*) *juniperi*, DeG., which were taken in places exposed to wind.

Meyrick (E.). **Exotic Microlepidoptera, iv, pt. 9.**—pp. 257–288. Marlborough, Wilts, the author, September 1932. Price 3*s.* per part.

Among the new species described are the Tineids, *Stathmopoda nucivora* bred from larvae feeding inside very young coconuts in the Solomon Islands, and *Depressaria cynarivora* bred in March from a larva found in February feeding on leaves of artichoke (*Cynara scolymus*) in Morocco.

Meyrick (E.). **Exotic Microlepidoptera, iv, pt. 10.**—pp. 289–320. Marlborough, Wilts, the author, October 1932. Price 3*s*. per pt.

Among the new species described are the Tortricids, *Eucosma* (*Spilonota*) *lechriaspis*, which is very injurious to apple in southern Manchuria and Korea, and *Argyroploce colivora*, bred from kola-nut (*Cola*) in Sierra Leone ; and the Pyralids, *Anartula thurivora*, feeding on leaves of *Cinnamomum zeylanicum* in Ceylon, and *Lamida carbonifera*, bred from larvae defoliating *Terminalia tomentosa* in India (Dehra Dun) and also recorded from Ceylon.

Maclagan (D. S.). **The Effect of Population Density upon Rate of Reproduction with special Reference to Insects.**—*Proc. Roy. Soc.*, (B) cxi, no. 773, pp. 437–454, 4 figs., 17 refs. London, 1st October 1932.

The following is almost entirely the author's summary : The present paper confirms in quantitative terms a suggestion previously put forward by the author that the effects of population density are of greater significance than generally realised. A survey of investigations on the subject shows that considerable confusion prevails on account of the experimental difficulties involved in the analysis of a true density effect. Analysis of existing data, combined with laboratory experimentation upon different insects, demonstrate the great definity of operation of the " space factor " ; also, the existence of an " optimum " density for rate of reproduction. The factors responsible, at different densities, for the reduction from the maximum reproductive rate have been examined, together with their possible significance in relation to certain phenomena in nature associated with migration and the epidemiology of insect pests. The results have been placed on a mathematical basis, in which an empirical formula, originally used by Farr, has been adapted, following the work of American investigators, to describe the relation between population density and rate of reproduction.

Austin (M. D.). **A preliminary Note on the Tarnished Plant Bug (*Lygus pratensis* Linn.).**—*J. R. Hort. Soc.*, lvii, pt. 2, pp. 312–320, 3 pls., 32 refs. London, September 1932.

Severe damage by *Lygus pratensis*, L., was caused to chrysanthemums in greenhouses in Sussex in 1930. Although it is probably the most common and widely distributed of native Capsids, no complete life-history under the conditions prevailing in Britain appears to have been hitherto recorded in any one paper. A preliminary account, combined with information from the literature, is therefore given of the data accumulated. The adult and immature stages are briefly described from the literature. Only adults have been observed to hibernate, but it is probable that the eggs do so in rare cases. Hibernation of adults occurs in sheltered rubbish-heaps, refuse in and near glass-houses and similar situations. Mortality is very high among hibernating adults. Mating did not occur until late January in the insectary, and eggs were not found in dissected females until late February. By mid-March eggs were almost ready to be laid. Oviposition has been observed in both spring and autumn. The distribution of *L. pratensis* is discussed. Other Capsids found in association with it on chrysanthemums included *L. pabulinus*, L., and *Calocoris norvegicus*, Gmel.

L. pratensis has a very extensive range of plants on which it is able to exist during certain periods of the year, readily leaving one type of plant for another. Definite migrations have been observed from currant to potato and thence to chrysanthemums. A list of the chief food-plants in Britain is given, together with one of a few of the plants attacked in other countries. Except in isolated cases this Capsid, which appears to be a pest of major importance abroad, seldom causes injury out of doors in Britain, although prevalent in many orchards and plantations. To the floricultural industry, however, it is of widespread importance, appearing year after year in certain nurseries and causing very serious damage to plants cultivated for cut blooms. Chrysanthemums and dahlias appear to suffer most, but asters are also attacked.

Attacks on chrysanthemums in the Worthing and Wye areas occur mainly at two distinct periods :—in the spring, when the damage is not often serious, and in the late summer and autumn, when the plants are brought into the glasshouses, and severe injury is frequently caused. Both immature stages and adults are found in the glasshouses at this time, and the former are often present during November and even later. The most noticeable of the various types of damage is that caused by the immature bugs, and sometimes by the adults, feeding near the tips of the shoots. The feeding punctures eventually cause stunting and malformation of the shoot, occasionally followed by the appearance of off-shoots. Stem injury also occurs, weakening the plants, both types of injury being accompanied by the formation of scarred areas. The flowers are frequently punctured in the bud stage, resulting in distorted blooms, and open blossoms are also attacked, individual petals being so heavily punctured that the blossom suffers and is discoloured. Severe foliage injury has only been seen on occasional plants. It was estimated that *L. pratensis* was responsible for damage to at least 20 per cent. of the plants in some centres, especially during the autumn of 1930.

Control measures should be preceded by the removal of outside sources of infestation, such as neglected currant or gooseberry bushes, weeds, and refuse in which hibernation may occur. If insecticides such as nicotine sprays are used, a thorough drenching of plants and insects is necessary to secure maximum efficiency. Brief notes are given on control measures tried by various workers. Chrysanthemums may be kept tolerably free from serious injury by *L. pratensis* by hand picking during the disbudding season. The predacious bug, *Anthocoris nemorum*, L., which was the only natural enemy observed during the present investigation, was frequently seen attacking the immature stages and even the adults, especially during October and November. The adult Anthocorids seem less ready than the nymphs to attack the Capsids. Although no other natural enemies appear to have been recorded in Britain, several are known in America [*R.A.E.*, A, v, 76 ; xii, 174 ; xix, 38].

SEIDEL (J.). **Stubenfliegen als vermeintliche Saatgutverderber.** [House-flies as supposed Pests of Seed.]—*Mitt. Ges. Vorratsschutz*, viii, no. 5, pp. 61–62. Berlin, September 1932.

Maggots, identified as those of *Musca domestica*, L., and *Muscina stabulans*, Fall., were found in April 1931 in Upper Silesia on beet-seed

that had been wetted to promote germination, which was, however, not noticeably affected by the infestation. The seed was cleared of larvae by exposing it to poultry, which do not eat it.

ANDERSEN (K. T.). **Das Getreidehähnchen** *Lema lichenis* **Voet.** —*Z. PflKrankh.*, xlii, no. 10, pp. 481–485, 4 figs. Stuttgart, October 1932.

In 1932 wheat was severely infested at Weihenstephan, Bavaria, by *Lema cyanella*, L. (*lichenis*, Voet). This Criocerid, which attacks various cereals and grasses, is usually less common in Germany than *L. melanopa*, L. [*cf. R.A.E.*, A, xiii, 530]. A brief description of the adult is given. In Germany there is one generation a year. After hibernating, the adults appear in April and May and feed and oviposit on the leaves. Oviposition lasts into July, and all stages occur together in that month. Owing to the cool, wet spring in 1932, only a few newly emerged adults were seen in July, the majority appearing in August, when the last larvae were still present. The pupal stage lasted 2–3 weeks, pupation occurring in yellowish-white cases of dried froth on the ears and leaves of the plants. The adults fed prior to hibernating. Two or three undetermined Hymenoptera parasitised about 20 per cent. of the pupae.

FULMEK (L.). **Die Runkelfliege im Tullnerfelde.** [The Beet-fly in the Tullnerfeld District, Austria.]—*Wien. landw. Ztg.*, lxxxi, no. 27, reprint 4 pp. Vienna, 4th July 1931. [Recd. October 1932.]

An exceedingly severe infestation by *Pegomyia hyoscyami*, Panz., of beet in seed-beds occurred in the summer of 1931 owing to the abnormally warm and dry spring. Adults from the overwintered pupae appeared in April and May, and those of the first generation in June. As a rule flies of a second generation appear later in the year. The measures advised were spraying with 2 per cent. tobacco extract with the addition of $\frac{1}{8}$ per cent. lysol or $\frac{1}{2}$ per cent. soft soap. A further addition of 2 per cent. methylated spirit can be made. When planting out the seedlings, all infested leaves should be removed and destroyed by burning, etc.

WATZL (O.). **Ueber ein Auftreten der Mittelmeerfruchtfliege** (*Ceratitis capitata* **Wied.) in Wien.** [On an Occurrence of the Mediterranean Fruit-fly in Vienna.]—*Gartenbauwiss.*, vi, no. 4, pp. 446–455, 4 figs. Berlin, 1932.

In the summer of 1931 *Ceratitis capitata*, Wied., was found in peaches, apricots and pears from gardens in Vienna, having probably been introduced in fruits from warmer countries. It is unlikely that it could survive the winter in the open, but it might possibly do so in fruit warehouses. Adult flies lived for 6 weeks in a heated room, but died within 10 days at temperatures averaging 5–8°C. [41–46·4°F.]. It was only at 15°C. [59°F.] that the flies became active. *C. capitata* has been recorded in England and occurs in France [*cf. R.A.E.*, A, xvii, 285], and a comparison of climatic conditions there and in Vienna shows that it cannot become a serious pest in Austria.

Miestinger (K.) & others. **Wichtige Schädlinge und Krankheiten der Rübe in Oesterreich.** [Important Pests and Diseases of Beet in Austria.]—*Bauernschr. niederöst. Landes-LandwKammer*, no. 37, 28 pp., 15 figs. Vienna, 1932.

This pamphlet includes brief accounts of the bionomics and control of the following insects: the weevils, *Otiorrhynchus* (*Cryphiphorus*) *ligustici*, L., *Bothynoderes punctiventris*, Germ., and *Cleonus piger*, Scop., the Silphids, *Blitophaga opaca*, L., and *B. undata*, Müll., *Cassida nebulosa*, L., flea-beetles, wireworms and Melolonthid larvae, *Loxostege* (*Phlyctaenodes*) *sticticalis*, L., *Euxoa* (*Agrotis*) *segetum*, Schiff., and the beet-fly, *Pegomyia hyoscyami*, Panz.

Vukasović (P.). **Opažanja o našim štetnim Insektima. I Serija: *Anthonomus cinctus* i *An. pomorum*; *Polychrosis botrana*; *Phlyctaenodes sticticalis*.** [Observations on our injurious Insects. 1st Series.]—*Acta Soc. ent. jugoslav.*, v–vi (1930–1931), fasc. 1–2, pp. 77–93, 7 figs. Belgrade [1932]. (With a Summary in French.)

An account is given of observations carried out near Belgrade and Smederevo in 1927–31 on *Anthonomus cinctus*, Redt., *A. pomorum*, L., *Polychrosis botrana*, Schiff., and *Loxostege* (*Phlyctaenodes*) *sticticalis*, L.

A. cinctus is a common and important pest of pears, 50 per cent. of the flower buds being sometimes destroyed. Branches on which buds have been attacked for several successive years are stunted and fail to bear fruit. The adults emerge from the pupae in late April and the first half of May, and exhibit marked heliotropism. In the laboratory they fed readily on the young leaves of pear before they had unrolled and on the leaf petioles, undeveloped buds, and green bark of young shoots. Cherry and plum were practically ignored. Feeding begins 3–6 days after emergence and lasts till about mid-June, when the weevils abandon the shoots and seek shelter to aestivate, becoming active again at the beginning of September. A certain amount of humidity is essential during aestivation; none of the weevils that were kept in the laboratory under dry conditions survived. The long period during which the weevils feed would permit of control by arsenical sprays. The anatomy of the digestive organs and female genitalia is described. The weevils do not become sexually mature until after aestivation. The rate of parasitism was 6 per cent. in 1927 and 4 in 1928, the parasites being the Ichneumonid, *Pimpla pomorum*, Ratz., and *Habrocytus* sp.

Anthonomus pomorum was abundant in 1928 and 1930, the larvae being found in flower buds of apple and pear. The majority of the adults emerged in the first half of May. In the laboratory they fed on the parenchyma of leaves, only leaving the veins; the feeding period lasted 25–30 days, and considerable humidity was necessary for aestivation. In experiments in which various leaves were offered to the weevils, those of apple were decidedly preferred, followed by pear and cherry; apricot was attacked very seldom, and plum and gooseberry were ignored. The reproductive organs of the female are described. *A. pomorum* was attacked by *Pimpla pomorum* and several unidentified Chalcids, the rate of parasitism varying from 10 to 27 per cent.

The vine moth, *Polychrosis botrana*, has become established in recent years, outbreaks occurring near Smederevo in 1928 and 1929, when the larvae destroyed about one-third of the crop of grapes. The adults

emerge from the pupae in early spring, and in the field almost full-grown larvae were found on flowering vines at the beginning of June. In the Smederevo vine-growing area there is no apparent relation between the development of the plant and that of the moth. The larvae of the last generation rapidly pupated in the laboratory when kept warm, and produced adults from the end of January till the beginning of April, which indicates that marked individual variations in development assist the adaptation of the insect to different conditions. Very few hibernating pupae were found under the bark of vine stems or in crevices in the poles, even in a vineyard in which 70 per cent. of the plants had been infested ; in the following year, however, infestation in the same vineyard was again severe. Several Ichneumonids and a fungus, possibly *Spicaria farinosa*, were observed to attack the larvae and pupae.

Serious outbreaks of *Loxostege sticticalis* occurred in 1929–31 over large areas on cabbage, *Capsicum* and garlic. Near Belgrade, mature larvae and pupae of the first generation collected on 18th June gave rise to adults on the 30th. Large numbers of the larvae were parasitised by *Tachina* (*Eutachina*) *civilis*, Rond., which abandoned the host when it reached the prepupal stage ; the adult flies emerged at the end of June. Some of the caterpillars were killed before they reached maturity by a Braconid, the adults of which began to emerge on 21st June.

Vukasović (P.). **O značaju hiperparazita u životnim zajednicama insekata.** [On the Importance of Hyperparasites in Insect Associations.]—*Acta Soc. ent. jugoslav.*, v–vi (1930–1931), fasc. 1–2, pp. 94–97, 4 refs. Belgrade [1932]. (With a Summary in French.)

In the course of studies on the activity and interrelations of parasites and hyperparasites of insects [*cf. R.A.E.*, A, xx, 259, 482], laboratory observations were carried out in Belgrade on *Aphidius medicaginis*, Mrsh., which was bred from the Aphid, *Macrosiphum pisi*, Kalt., an outbreak of which occurred on lucerne in Jugoslavia in 1930, and on the hyperparasites attacking this Braconid, *viz.*, the Pteromalids, *Asaphes vulgaris*, Wlk., and *Pachyneuron aphidis*, Bch., and the Cynipid, *Charips* (*Allotria*) *victrix*, Westw. It was found that the percentage of Braconids parasitised was very high and was invariably much higher than that of parasitism in the Aphid, about 50 per cent. being killed by *Asaphes vulgaris* alone.

Hergula (B.). **Daljnji prilog proučavanju kukurozova moljca** (*Pyrausta nubilalis* **Hübner**) **i njegovih parasita u Jugoslaviji.** [Further Contribution to the Study of the Maize Moth and its Parasites in Jugoslavia.]—*Acta Soc. ent. jugoslav.*, v–vi (1930–1931), fasc. 1–2, pp. 98–117, 7 graphs, 2 refs. Belgrade [1932]. (With a Summary in German.)

Supplementing previous data on *Pyrausta nubilalis*, Hb., and its parasites in Jugoslavia [*R.A.E.*, A, xvii, 219 ; xviii, 149 ; xix, 153], a brief survey is given of the infestation of maize by this moth in 1929–31 in eastern Croatia. Early maturing varieties of maize were much more severely infested than late ones. There was one generation a year, with sometimes a partial second, in which not more than 1–3 per cent. of the borers were involved. In observations in an open-air insectary in 1931 pupation occurred from the end of May till the beginning of August, the pupal stage lasting 8–15 days. Pupae were most

numerous, however, between 28th June and 2nd July, and 50 per cent. of the moths emerged between 8th and 14th July. Eggs were laid from the end of June till mid-August, and the larvae hatched from the beginning of July onwards. Owing to lack of humidity in the insectary, the development of individual stages was somewhat protracted.

Of the parasites attacking the larvae in 1930 and 1931, *Eulimneria* (*Limnerium*) *alkae*, Ell. & Sacht., destroyed on an average 1·9 per cent., the adults emerging between 21st April and 9th May. *Angitia* (*Inareolata*) *punctoria*, Roman, attacked 5·7 per cent. in one locality and 1·1 per cent. in another; the larvae of the parasite abandoned those of the host in late May or June and pupated in cocoons, the pupal stage lasting 8–14 days. Two cocoons of *Exetastes illusor*, Grav., which has not previously been recorded as a parasite of *P. nubilalis*, were found in the autumn of 1930 in tunnels of the borer; from one of them an adult emerged in the following May. *Microbracon brevicornis*, Wesm., caused parasitism varying in different localities from 0·8 to 4·3 per cent. The adults emerged from mid-July till 4th October, two complete generations and a partial third being produced. The egg stage lasted 1–2 days, the larval 3–6, and the prepupal and pupal stages together 10–19. *Macrocentrus* sp. [*cf.* xix, 436] caused 0·2–0·3 per cent. parasitism in two localities. The number of parasites developing from a larva varied from 16 to 36. This species is polyembryonic, and the larvae living in one host are all of the same sex; instances, however, were observed of both sexes emerging from one host larva, indicating that several eggs had been deposited in it. On abandoning the host, the parasite larvae make separate small cocoons inside a common large one; the spinning of the cocoons occupies 1–2 days, and the adults emerge 8–13 days later. Pairing takes place soon after emergence; in the laboratory the adults lived 8–21 days. *Eulophus viridulus*, Thoms., parasitised about 0·1 per cent. of the larvae near Zagreb. The egg stage lasted 2 days, the larval 6, and the prepupal and pupal 11. The Tachinid, *Ceromasia senilis*, Mg., was recorded from 3 localities, the degree of parasitism varying from 10 to 0·06 per cent. Empty puparia found in the tunnels of the borer indicate that a partial second generation had developed. In 1931 pupation occurred between mid-April and 8th May, and the pupal stage lasted 16–24 days.

FEYTAUD (J.). **La question doryphorique au début de la campagne 1932.**—*Rev. Zool. agric. appl.*, xxxi, no. 5, pp. 65–88, 3 maps. Bordeaux, May 1932. [Recd. October 1932.]

The infestation of *Leptinotarsa decemlineata*, Say, on potato in France increased both in density and in area during 1931, as in the preceding year [*R.A.E.*, A, xix, 696]. Its distribution is discussed in detail, with lists of the infested and protected zones. It has spread in all directions, but particularly northwards, in the Loire basin, as was expected, and has even been discovered in a few fields north of the river. The regulations regarding transport and international trade in the vegetables affected are explained; no potatoes, tomatos or egg-plants grown in the infested zones may be exported. The prompt and consistent carrying out of co-operative measures is considered essential for reducing infestation. These include general inspection of all solanaceous plants; cultural methods tending to keep foliage attractive to

L. decemlineata available in centres of infestation for as long a season as possible; collection of adults, mature larvae and eggs, and burning of stalks infested with young larvae; and the use of arsenical sprays or possibly dusts. In the centres of infestation, the collection of adults is essential for preventing the dissemination of the pest.

VANDEL (A.). **Le sexe des parasites dépend-il du nombre d'individus renfermés dans le même hôte?**—*Soc. ent. France, Livre du Centenaire*, pp. 245–252, 19 refs. Paris, 1932.

In connection with the problem of the determination of the sex of animals during the course of their development, the author has studied several examples in which there is some connection between the sex of a parasite and the number of individuals contained within a single host. In the case of Strepsiptera and Monstrillids, this relation is very probably determined by the selective elimination of one of the sexes. In that of *Mermis subnigrescens*, Cobb, however, the sex of the parasite is found to be directly dependent upon the number of individuals within one host.

[VUKASOVIĆ (P.).] VOUKASSOVITCH (P.). *Isobremia kiefferi*, **Diptère prédateur des pucerons.**—*Soc. ent. France, Livre du Centenaire*, pp. 319–327, 4 figs. Paris, 1932.

A further account is given of *Isobremia kiefferi*, Vouk. [*R.A.E.*, A, xiii, 150], with a full description of the adult, including the internal anatomy. This Cecidomyiid has been found to be predacious on numerous species of Aphids in several parts of Jugoslavia. Both eggs and larvae have been observed at the beginning of June, though hatching generally occurs rather later in the month. The eggs are usually placed in groups of three or four, fixed to some part of the plant attacked by the Aphid, and hatch in from two to four days according to their position on the plant. Its method of attacking and feeding on the Aphid is described. It is very irregular both in appearance and numbers, even on different parts of the same plant, and it does not seem to account for any high degree of mortality among Aphids.

BALACHOWSKY (A.). **La théorie des "places vides" et le peuplement des végétaux par les Coccidae.**—*Soc. ent. France, Livre du Centenaire*, pp. 517–522, 6 refs. Paris, 1932.

This is an amplification of part of the author's previous work on Coccids of North Africa and the South of France [*R.A.E.*, A, xx, 597].

VAYSSIÈRE (P.). **Insectes utiles ou nuisibles acclimatés en France ou dans les Colonies depuis un siècle.** —*Soc. ent. France, Livre du Centenaire*, pp. 629–648, 80 refs. Paris, 1932.

Brief notes are given on the history and habits of the insects that have been introduced into France or the French Colonies either by accident or design during the past hundred years. In some cases it cannot be stated with any certainty whether a given insect is an introduced species or an indigenous one that has escaped notice until recent years.

Borg (P.). [Report of the] **Plant Pathologist.**—*Ann. Rep. Dept. Agric. Malta 1931–32*, pp. xv–xix. Malta, 1932.

Several of the insect pests mentioned in this report have already been noticed [*R.A.E.*, A, xviii, 261–262; xix, 730]. *Chrysomphalus ficus*, Ashm., was intercepted in two consignments of oranges from Jaffa. Owing to favourable weather throughout the summer, *Ceratitis capitata*, Wied., caused severe injury to summer fruits and to *Citrus*. It has been found that an early brood is able to develop in the flower-buds of caper (*Capparis spinosa* var. *rupestris*) in May, and as this plant, the fruit of which is also severely infested, is widely distributed throughout the Island, control of the fly is rendered very difficult. Moreover, the pupae are able to overwinter in caper fruits, as they do in dried oranges left hanging on the trees. Hibernation also occurs in the egg stage. The author considers that attempts to introduce *Syntomosphyrum indicum*, Silv., for controlling *C. capitata* will not be successful, in view of the failure to establish it in Sicily [*cf.* xviii, 179], the parasite being unable to survive the winter. Figs were severely attacked by *Ceroplastes rusci*, L.

Kusnezov (V.). **Zwei neue schädliche Homopteren aus Zentral-Asien.** [Two new injurious Homoptera from Central Asia.]—*Wiener ent. Ztg.*, xlix, no. 3, pp. 155–157, 3 figs. Vienna, October 1932.

Erythroneura cyclops, sp. n., on *Tamarix*, and *E. asiatica*, sp. n., on cotton, gherkin, lucerne and willow (*Salix*), are described from Uzbekistan.

Smee (C.). **Report of the Entomologist** [for 1931].—*Ann. Rep. Dept. Agric. Nyasaland 1931*, pp. 44–46. Zomba [1932].

Termites, of which *Acanthotermes militaris*, Hagen, is probably the most common, constitute a serious problem in Nyasaland in view of the damage they cause to young tea bushes. They appear to enter the wood through wounds or cuts caused by pruning, but sometimes gain access by severing the shoots of unpruned and apparently healthy bushes. Young tea plants were defoliated in small patches in one district by *Podagrica* (*Nisotra*) *suahelorum*, Wse. (red-headed flea-beetle), which may also be found on several leguminous cover crops, particularly certain varieties of beans. In confirmation of the statement that *Anthores leuconotus*, Pasc. (white stem-borer) is not killed if infested coffee bushes are merely uprooted and discarded, it is recorded that beetles have been reared in captivity from eggs laid on portions of stems having no roots or foliage. Considerable damage was caused to the fruits of nectarine by *Colasposoma* sp., and to those of peach and fig by *Plaesiorrhina trivittata*, Sch. (peach fruit beetle). An ant, ? *Myrmicaria eumenoides*, Gerst., was observed to cut off leaves of young *Citrus* trees. Heavy infestation of ground-nut seedlings by millepedes was reported. For the second year in succession an outbreak of the Galerucid, *Exora apicipennis*, Jac., occurred in December on sunn hemp [*Crotalaria juncea*] in experimental plots. *Indigofera endecaphylla* was also badly attacked, but *Cajanus indicus*, which was readily available, was practically untouched. The outbreak subsided within a week. This beetle might possibly be confused with *Ootheca mutabilis*, Sahlb., which is common on all leguminous crops and frequently causes

severe damage to them and to cotton. The latter beetle appears later, has a wider range of food-plants and seems to remain prevalent for a considerable length of time.

GAHAN (A. B.). **Two new Species of Encyrtidae (Hym.) from Kenya Colony.**—*Stylops*, i, pt. 10, pp. 220-222. London, 15th October 1932.

The species described are *Aphidencyrtus africanus*, sp. n., bred from *Toxoptera aurantii*, Boy. (*coffeae*, Nietn.), and *A. coccidicola*, sp. n., from a Coccid, in Kenya Colony.

ANDERSON (T. J.). **Entomological Section. Annual Report, 1931.**—*Ann. Rep. Dept. Agric. Kenya 1931*, pp. 99–117. Nairobi, 1932.

H. Wilkinson reports that *Locusta migratoria migratorioides*, Rch. & Frm., heavily infested large tracts of Kenya during 1931, but confined its attacks to Graminaceae except during periods of dry weather; during September–December it was frequently accompanied by *Schistocerca gregaria*, Forsk. *Phymateus viridipes*, Stål (coffee locust) and *Zonocerus variegatus*, L., were present in smaller numbers. *Busseola fusca*, Fuller (maize stalk borer) increased during the year, sometimes infesting 60 per cent. of the maize stalks; good agricultural practices and planting within a certain well-defined period are recommended against it [*R.A.E.*, A, xx, 117].

Coffee pests recorded by R. H. Le Pelley were *Antestia* and *Lygus* [*simonyi*, Reut.], against which a kerosene extract of pyrethrum was used [*cf.* xx, 500, etc.], though its value is limited owing to its scarcity and the fact that its application requires considerable skill, and the mealybug (*Pseudococcus lilacinus*, Ckll.), against which spraying has now been proved to be definitely ineffective [*cf.* xx, 116]. According to F. B. Notley, the stem borer, *Apate monacha*, F., occurred in some districts, and blackening of coffee blossoms was found to be due in part to an unidentified Capsid. The leaf-eating caterpillar, *Metadrepana andersoni*, Tams, was very injurious in one area.

Insectary work, under T. L. McClelland, included the breeding of Coccinellids for distribution to coffee estates against *P. lilacinus*. The importation of *Cryptolaemus montrouzieri*, Muls., has unfortunately not resulted in the establishment of this predator. Indigenous species were also bred, the most satisfactory being *Scymnus guttigera*, Kors. (*guttulatus*, Sicard) and *S. ancoralis*, Sicard, numbers of which have been distributed to plantations. The present methods of banding against ants attending the mealybugs are unfortunately detrimental to the activities of the species of *Scymnus*, which crawl down the trunks to pupate and so get caught in the bands.

H. C. James continued his work on the mealybug problem [xviii, 566; xix, 230]. Although microscopic examination of the common mealybug in Kenya seems to indicate its identity with *P. lilacinus* as occurring in the Philippines, Java, Ceylon and South India, the latter is considered to be viviparous whereas the Kenya form is oviparous, although the period of external incubation is short (37 hours in individuals examined). It seems probable that climatic and other environmental factors may greatly alter the duration of the egg stage in Coccids; *Coccus viridis*, Green, which is viviparous in Asia, has an egg stage of about 11 days in Cuba, where it is has recently been introduced. A great deal of evidence has been accumulated

which indicates that *P. lilacinus* is of recent introduction into Kenya and possibly that it is increasing its range of food-plants there. No evidence has been obtained in support of the view that there are various strains or biological races of it, each with a restricted range of food-plants ; and individuals have been successfully transferred from *Combretum splendens* to coffee and from coffee to *Hibiscus* spp.

For repelling the ants that foster the mealybug [xviii, 566], the most popular type of band is generally composed of some proprietary tanglefoot grease, applied on burlap or paraffin wax, though a repellent that could be poured or sprinkled round the bases of closely-planted coffee trees would be of the greatest value as a substitute for the troublesome and expensive banding process. Others in use are kresotow [*loc. cit.*] and castor oil with or without resin, both these materials being repellent and toxic to the ants. Tests are being made to determine the duration of efficacy of castor oil in the field and whether this is prolonged by the addition of resin. At present a mixture of 70 per cent. castor oil and 30 per cent. resin is suggested ; this has remained effective for nearly eight weeks. Banding trials with castor oil and resin preparations containing mercury bichloride showed that the poison did not add to their effectiveness. The usual method of applying kresotow or castor oil is to place a band of cotton wool round the trunk, and over this a band of grease-proof paper. Over this again is fixed a band of fabric soaked in the repellent. Cellophane proved better than grease-proof paper, as it obviates loss through absorption of oil by the paper and also completely prevents the oil from coming into contact with the tree beneath. The lower edge of the fabric band, which should be at least 3 ins. wide, should be doubled up by half an inch to prevent the oil from dripping. Bands of coarse cloth such as hessian dry out the quickest, and the better qualities of cotton cloth hold the oil less well than the cheaper grades. Blanket cloth has been used in some cases as a cheap and effective substitute for the cotton wool. Whatever material is used in contact with the tree, the bark should always be thoroughly rubbed with sacking at the point where it is intended to place the band. The application of proprietary banding greases direct on to the bark is not recommended. Paraffin wax with a melting point of 112°F. was tried for carrying them, but it did not keep its shape in the heat of day and is difficult to apply to closely-planted trees.

The fact that in the unshaded conditions of most coffee plantations the male mealybugs seek the bases of trees and the soil for their final transformation offers possibilities of control, although experiments have shown that this species can maintain itself parthenogenetically.

TRENCH (A.). **Coffee Section. Annual Report, 1931.**—*Ann. Rep. Dept. Agric. Kenya 1931*, pp. 158–175. Nairobi, 1932.

Pests of coffee not mentioned in the preceding abstract included : *Anthores leuconotus*, Pasc. (white borer), which, though widely distributed, is generally well under control ; *Stephanoderes hampei*, Ferr., which is not under control in two districts, in which movement of coffee should be kept under supervision, any sold locally being first mechanically dried and certified free from infestation ; *Dasus* (*Gonocephalum*) *simplex*, F. (bark-eating beetle), which did serious damage to plants up to 3 years old ; and an Aleurodid that severely infested four acres on one

plantation. Isolated outbreaks occurred of thrips, *Thliptoceras octoguttale*, Feld. (coffee berry moth) and the leaf miner moth [*Leucoptera coffeella*, Guér.].

Le Cerf (F.). **Lépidoptères nouveaux du Moyen Atlas (Noctuidae, Lasiocampidae).**—*Bull. Mus. Hist. nat.*, (2) iv, no. 5, pp. 510–515. Paris, June 1932.

Among the new species described from Morocco is *Dendrolimus pini*, L., subsp. *atlantica*, n. This species, which is a well known pest of pine in Europe and Asia, has not been previously recorded from Africa, where it appears to have adapted itself to cedar [*Cedrus atlantica*].

André (M.). **Compte rendu d'une mission dans le Sud-Algérien (mai 1932) pour l'étude d'un acarien nuisible au dattier.**—*Bull. Mus. Hist. nat.*, (2) iv, no. 5, pp. 521–532, 1 pl., 1 map, 8 refs. Paris, June 1932.

Further details are given of the bionomics and distribution in Algeria of a Tetranychid mite causing serious injury to dates [*R.A.E.*, A, xx, 267]. The identity of this mite has not yet been determined.

Smit (B.). **Fumigating *Citrus* Trees by new Methods.**—*Fmg. S. Afr.*, 1932, reprint no. 58, 2 pp., 2 figs. Pretoria, July 1932.

An account is given of the various methods of using hydrocyanic acid gas for tent fumigation of *Citrus* against Coccids in South Africa. A hand-pump was found to give insufficient pressure in the application of cyanogas calcium cyanide dust, but a power blower has given excellent results in extensive tests. The difficulty in distribution is lessened by the use of calcid calcium cyanide dust, which is almost chemically pure calcium cyanide and thus contains a higher percentage of cyanogen than does cyanogas [*cf. R.A.E.*, A, xiv, 74, 246], so that a smaller amount of material is required to give an equal dose. It is manufactured in small blocks weighing 20 gm., each of which contains 10 gm. cyanogen, and is applied by means of a hand machine that grinds and blows the dust in one operation [*cf.* xix, 195].

Faure (Jacobus C.). **The Phases of Locusts in South Africa.**—*Bull. Ent. Res.*, xxiii, pt. 3, pp. 293–424, 25 pls., 1 map, 27 refs. London, September 1932. Separately published, price 12*s*.

This comprehensive paper is based on observations made during the last four years at the University of Pretoria. Numerous breeding experiments with *Locustana pardalina*, Wlk., and *Locusta migratoria migratorioides*, Rch. & Frm., have confirmed the theory of phases in locusts. The crowding and isolating of the insects invariably produced hoppers and adults of the *gregaria* and *solitaria* phases respectively, the percentage of individuals of the former varying directly with the density of population. These results were corroborated by experiments on *Nomadacris septemfasciata*, Serv., and *Schistocerca gregaria*, Forsk. The adults of *Locustana pardalina* and *Locusta m. migratorioides* were studied biometrically, and a standard of measurements that can be used in the classification of the phases was arrived at; in hoppers the coloration was used as the standard of comparison. It was found that the characteristic yellow or orange and black coloration

in phase *gregaria* develops only under crowded conditions. In phase *solitaria* the coloration was very variable, being greatly influenced by that of the environment, but green was produced only in hoppers kept in a humid atmosphere and supplied with an abundance of succulent food. Chemical tests, however, showed chlorophyll to be absent from the tissues of green hoppers of *L. m. migratorioides*. The author proposes the following terms for the different colorations of hoppers: " hypermetabolic " for that of the *gregaria* phase ; " nutritional " for green ; and " imitative " for other colours of the *solitaria* phase.

The life of hoppers under crowded conditions is characterised by an abnormal activity, and the consequent great increase in the rate of metabolism produces a surfeit of excretory products, which cannot be disposed of by the malpighian tubules. These products or their derivatives are deposited in the cuticula in the form of a definite pattern, which is characteristic of *gregaria* hoppers. The term " locustine " is proposed for the products of excessive metabolism, and it is suggested that the black coloration in the first instar of the progeny of *gregaria* adults and the gradual intensification of the *gregaria* characters through several crowded generations are due to the inheritance of locustine through the yolk of the egg. The constriction of the pronotum and the length of wings in the adults of the *gregaria* phase are probably due to the enormous amount of muscular contraction involved in the constant activity of *gregaria* hoppers. The fact that *gregaria* characters disappear as soon as locusts are isolated shows that the phenomenon of phases is not due to inheritance of acquired characters. Moreover, mendelian inheritance cannot be the cause of differences in coloration of hoppers, since in observations on the progeny of 34 different pairs of *Locustana pardalina*, they acquired *gregaria* or *solitaria* characters according to the environment, regardless of the phase to which the parents belonged.

To prove that an excessive rate of metabolism resulting from muscular activity is the cause of variation towards the *gregaria* phase, numerous attempts were made to stimulate isolated hoppers to continual activity, but it was found that after a certain time they invariably became used to the various stimuli and did not react to them. It was found that *gregaria* characters are developed more readily in hot than in cool weather and that their development is not influenced by moisture or light.

The previous invasions and geographical distribution of *L. pardalina* in South Africa are discussed, with a map illustrating the range of invasions by its swarms, its permanent habitat (areas in which phase *solitaria* is always found), and the areas of incipient swarming. The author is convinced that the invasions of the grass-veldt areas of the northern Kalahari, eastern Orange Free State, Transvaal and Southern Rhodesia have originated in the past from swarms migrating out of areas bearing the Karroo type of semi-desert vegetation. It was found that the eggs of this species will remain alive for 37 months if kept dry.

VAN DER MEER MOHR (J. C.). **Entomologische Aanteekeningen, II.** —*Meded. Deli Proefst.*, (2) lxxvi, pp. 1–16, 5 figs. Medan, 1932. (With Summaries in English.) (Reprinted from *Ind. Culturen*, xvii, nos. 12–14. Batavia, 1932.)

These notes from Sumatra include records of injury to the underground parts of tobacco in 1932 by *Pycnoscelus surinamensis*, L., in

three localities on the east coast. In one plantation some seed-beds suffered losses of more than 100 seedlings a day, and in another, tobacco recently planted out was so severely attacked that about 300,000 plants had to be replaced. In the third locality *Gryllotalpa africana*, P. de B., occurred together with the cockroach and did most of the damage.

Larvae of the Melolonthid, *Lepidiota stigma*, F., were found eating out parts of the stems of young tobacco plants just above the roots. This attack was confined to some 200 plants on a very limited area of loose, sandy soil, no larvae being found in clay soil. Cassava was growing in adjacent ground and had been growing where the infested tobacco had been planted. Adults of the Rutelid, *Anomala viridis*, F., and the Melolonthid, *Pentelia discedens*, Sharp, have been observed causing occasional slight damage to tobacco in the fermenting shed.

Pescott (R. T. M.). **The Cypress Pine Girdler** (*Diadoxus erythrurus* **White**).—*J. Dept. Agric. Vict.*, xxx, pt. 8, pp. 396–397, 5 figs., 2 refs. Melbourne, August 1932.

In the north and north-west of Victoria, the native cypress pines, *Callitris robusta* and *C. robusta* var. *microcarpa*, when weakened in unfavourable seasons, are subject to the ravages of insect pests, particularly the cypress pine girdler, *Diadoxus erythrurus*, White. Besides these native trees, which are usually only secondarily infested, cypresses such as *Cupressus lambertiana*, grown for hedges or ornamental purposes, may be attacked and totally destroyed. This Buprestid has a wide range and is found wherever the native cypress pines grow. The adult is described. Emerging from the tree in the summer months, it oviposits in crevices of the bark, and the young larvae bore into the sapwood, where they feed until they are full-grown, finally girdling the tree and causing its death. They pupate in their tunnels, and some considerable time may elapse before the adults emerge. Susceptible trees should not be planted in the districts where *Callitris* grows. Once the tree is infested, it is very difficult to reach the larvae in the trunks ; where there are only a few holes, they may be treated by inserting a rag dipped in carbon bisulphide into them and plugging the entrances with clay or soap. A tree or portion of a tree that is badly infested should be removed and immediately burnt, and adjacent trees should have the lower 4 or 5 feet of the trunk sprayed with kerosene emulsion, tar water or some other deterrent against ovipositing beetles.

Urich (F. W.). **The Arrowroot Leaf Roller** (*Calpodes ethlius*).—*Trop. Agriculture*, ix, no. 10, pp. 299–300. Trinidad, October 1932.

Notes are given on the bionomics of *Calpodes ethlius*, Cram., on arrowroot in St. Vincent, based on observations during the author's brief visits to the Island in August 1931 and April 1932. It occurs from the south-eastern United States to Argentina and throughout the West Indies, *Canna* being the chief food-plant in most countries and arrowroot wherever it is grown.

Apart from the fact that the caterpillars defoliate the plants, the economic importance of this Hesperiid is not definitely known [*cf. R.A.E.*, A, xiv, 87 ; xv, 52]. The extent of defoliation varies from year to year and is affected by the abundance of natural enemies

and weather conditions. In August most of the fields showed signs of severe past damage, many of the plants having been completely defoliated. Comparatively few caterpillars were present, and rough field counts showed that 30 per cent. of them had been killed by unidentified Tachinids and 3 per cent. by the Eulophid, *Elachertus meridionalis*, Crwf., and 25 per cent. of the eggs by *Trichogramma minutum*, Riley. There is no regular season for harvesting arrowroot in the Island, this being usually done between October and March, before the rains set in. The new growth begins to appear about a month after cropping, and it is at this stage that the plants are most prone to injury. Fields are often severely defoliated several times before the larvae are attacked by natural enemies. The females prefer young growth for oviposition and often concentrate on individual fields. The predominance of a given immature stage appeared to depend on the state of growth of the plants after harvest. In April, eggs, many of which showed parasitism by *Trichogramma*, were predominant in a field that had been cropped in January, whereas a field that had been cropped 5 months previously contained larvae, most of which were fully grown. The egg stage occupies 4 days, the larval 12 and the pupal 6.

Owing to the habit of the larvae of feeding under shelters formed by rolling the margins of the leaves, biological control would appear to be more practicable than the use of insecticides. Parasites occurring in Trinidad include : *Ooencyrtus* sp. and *Anastatus* sp., attacking the eggs ; and *Apanteles talidicida*, Wlkn. (which is itself parasitised by *Spilochalcis* sp.), *Microbracon* sp. and two undescribed Tachinids, all attacking the larvae.

Wildermuth (V. L.) & Walter (E. V.). **Biology and Control of the Corn Leaf Aphid with special Reference to the south-western States.**—*Tech. Bull. U.S. Dept. Agric.*, no. 306, 21 pp., 13 figs., 22 refs. Washington, D.C., May 1932. [Recd. October 1932.]

As the result of 20 years' study in the south-western United States, the authors give an account of *Aphis maidis*, Fitch (corn leaf aphis). Its distribution and history are discussed, with a list of its food-plants, of which the chief are wild and cultivated grasses and some common weeds. The greatest damage in the United States is done to barley, *Sorghum* and maize, the insect being also responsible for the transmission of mosaic disease of sugar-cane. It is doubtful whether normal breeding occurs on plants of any order other than Gramineae. Sexual forms have never been taken in the field in the United States or recorded in any other country, but in cage rearings, which are described, alate males were obtained on rare occasions during very mild winters. It is thought probable that in the process of evolution, *A. maidis* has developed to a point where it is maintained continually by viviparous parthenogenetic reproduction. Males required from 2 to 9 days longer to reach maturity than apterous, viviparous females, which developed in an average of 5·25 days during July–August, 11·05 during March–April and about 20 in winter. A description of the male is given. It is not known how or whether the insect overwinters in the north ; the number of generations a year has been known to vary from 9 in Illinois to as many as 50 in Texas.

A. maidis has a large number of natural enemies, those in the United States including 13 Coccinellids, of which *Hippodamia convergens*,

Guér., and *Ceratomegilla fuscilabris*, Muls., are the chief, 7 Syrphids, of which the most important is *Allograpta fracta*, O. S., the Braconid, *Lysiphlebus testaceipes*, Cress., and the lacewing, *Chrysopa californica*, Coq. Early planting and thorough cultivation will hasten the maturity of the crops and enable them to outgrow much of the injury. Heavily infested young barley may almost entirely be freed of the pest by allowing cattle to feed on the plants.

Webber (R. T.). *Sturmia inconspicua* **Meigen, a Tachinid Parasite of the Gipsy Moth.**—*J. Agric. Res.*, xlv, no. 4, pp. 193–208, 6 figs., 7 refs. Washington, D.C., 15th August 1932.

The following is taken from the author's summary: In Europe, *Sturmia inconspicua*, Mg., is an effective parasite of *Porthetria dispar*, L., and is also the most important Tachinid parasite of *Diprion similis*, Htg., and in view of the recent introduction of this sawfly into the north-eastern United States, the establishment of *S. inconspicua* should prove of decided benefit. The parasite is indigenous to central Europe and is commonly found in northern Africa. Attempts to colonise it against *P. dispar* in the north-eastern States were made between 1906 and 1910, but were unsuccessful. Since 1923, large colonies have again been liberated, and in 1929 the first recovery was made. All stages of *S. inconspicua* are described. The winter is passed as a first-stage maggot within the larva contained in the cocoon of any of several species of *Diprion* or possibly in some Lepidopterous pupae, seven of the many insects from which this parasite has been reared being indigenous to the United States. In the following spring the maggot emerges and pupates, the adult appearing in about 2 weeks. There are two generations a year. The flies readily paired in cages, the males frequently fertilising more than one female. The pre-oviposition period usually occupies 12–14 days. In the laboratory, flies live for 4 or 5 weeks. Parthenogenesis apparently does not occur. The eggs are attached to the skin of the host larva and hatch immediately; the average duration of the larval stage is about 14 days and of the pupal stage about 10. Superparasitism is common, as many as 7 individuals having been obtained from one host. Two parasites attack *S. inconspicua* in Europe [*R.A.E.*, A, xiii, 445], but none is known in the United States. Owing to its rapid development, *S. inconspicua* is not likely to suffer from competition with other parasites.

Britton (W. E.). **The Elm Leaf Beetle Outbreak.**—*Circ. Connecticut Agric. Expt. Sta.*, no. 84, pp. 29–34, 5 figs. New Haven, Conn., April 1932. [Recd. October 1932.]

The elm leaf beetle [*Galerucella luteola*, Müll.] was abnormally destructive in Connecticut in 1931, severe injury being also reported from other parts of the north-eastern United States [*cf. R.A.E.*, A, xix, 348]. It is distributed throughout the eastern States as far west as Indiana and Kentucky, being also present in California, Oregon and Washington, and it shows a preference for *Ulmus campestris*, *U. montana*, and *U. americana*, seldom attacking *U. fulva*, *U. alata*, *U. racemosa* or *U. suberosa*. Notes are given on its bionomics [*cf.* xviii, 708].

The most important agent of natural control in Connecticut is probably the fungus, *Beauveria* (*Sporotrichum*) *globulifera*, which

infests the pupae and adults in late summer, especially in damp seasons. The larvae and pupae are attacked by *Podisus* spp., of which *P. maculiventris*, Say, is the most important, and certain birds feed on the larvae. The lower surface of the leaves of the trees should be sprayed early in July, about the time the eggs hatch, with 5–8 lb. lead arsenate in 100 U.S. gals. water. Where this treatment has not been applied or has proved unsuccessful, the pupae round the base of the tree may be killed by spraying with a contact insecticide such as nicotine sulphate and soap. Treatment should be carried out in all infested areas and applied to trees in the streets and on private property. The hibernating adults should be destroyed wherever possible.

KEIFER (H. H.). *Ephestia kuehniella fuscofasciella* **Rag. in California.**—*Pan-Pacific Ent.*, viii, no. 4, p. 156. San Francisco, Cal., April 1932. [Recd. October 1932.]

Ephestia kühniella fuscofasciella, Rag., was found in California in March 1928 breeding in acorns stored by woodpeckers in loose bark on dead trees and stumps. It has been successfully reared on almonds and raisins, showing it to have the same potentialities as the typical *E. kühniella*, Zell. The characters distinguishing it are indicated.

FELT (E. P.). **A new predaceous Gall Midge for California.**—*Pan-Pacific Ent.*, viii, no. 4, pp. 167–168. San Francisco, Cal., April 1932. [Recd, October 1932.]

Descriptions are given of both sexes of *Silvestrina koebelei*, sp. n., previously recorded as *Diplosis* sp. [*R.A.E.*, A, xvii, 72; xviii, 77; xx, 22], which was introduced from Australia against *Pseudococcus gahani*, Green. This predacious Cecidomyiid has apparently become established in California, but its influence on the mealybug appears to be negligible.

PARKS (T. H.). **The Present Hessian Fly Situation.**—*Bi-m. Bull. Ohio Agric. Expt. Sta.*, no. 158, pp. 168–172, 2 maps. Wooster, Ohio, 1932.

A survey of the wheat fields of Ohio just prior to the harvest in 1932 has shown that a significant and unexpected increase in the numbers of the Hessian fly [*Mayetiola destructor*, Say] took place during the year. Thirty-five per cent. of the straws contained puparia, the degree of infestation being the highest since 1920 [*R.A.E.*, A, viii, 531]. The greatest increase had occurred where the wheat had been sown before the fly-free dates. Numbers of the pupae, however, had been killed by parasites and climatic conditions during the summer, and the situation is not considered serious.

Report of the Department of Entomology.—*Rep. New Jersey Agric. Expt. Sta. 1930–31*, pp. 139–253, 12 figs. New Brunswick, N.J., 1932.

Much of the information in this report on investigations in New Jersey during the year ending 30th June 1931 has been previously noticed [*R.A.E.*, A, xix, 363, 486; xx, 419, 420, 519]. Dealing with work on orchard pests, T. J. Headlee (pp. 186–189) states that in

further experiments on the control of the leopard moth [*Zeuzera pyrina*, L.] on apple [xx, 82], a spray of miscible pine oil (pineole soluble) and naphthalene (dissolved at the rate of 50 gm. to 300 cc. and the whole diluted with equal parts of water) reduced the number of living larvae to about one-quarter of those on untreated trees. Tank-mixed nicotine tannate [*cf.* xix, 358; xx, 515], with 3 lb. powdered sweet skim milk per 100 U.S. gals. as a spreader, and white oils impregnated with rotenone or pyrethrum were tested as substitutes for arsenicals used for the control of the codling moth [*Cydia pomonella*, L.] on apples. The control obtained was satisfactory but slightly inferior to that resulting from the same number of lead arsenate sprays. Impregnated oil is less costly but cannot be used with a fungicide and also causes injury to foliage having a considerable residue of sulphur, and should it become possible to increase the retention of nicotine tannate on foliage and fruit and thus reduce the number of applications necessary, this substance will probably become the preferred substitute.

B. F. Driggers (pp. 191–193) describes insectary investigations on the biology of *Syntomosphyrum esurus*, Riley, *Macrocentrus ancylivora*, Rohw., and *M. delicatus*, Cress., parasites of the oriental peach moth [*C. molesta*, Busck]. Adults of *Syntomosphyrum* emerged in May; the development of the summer broods lasted 15–33 days, and the number of parasites reared from a single host pupa averaged 37. Adults of *M. ancylivora* first appeared in May, and those of *M. delicatus* 10–14 days later, in June. Injury to nectarines and peaches in early July 1930 appeared to have been caused by adults of the plum curculio [*Conotrachelus nenuphar*, Hbst.], larvae of which were observed in ripening peaches on 8th August. In view of the possibility that this indicated the occurrence of a partial second brood [*cf.* xix, 340], observations were continued in 1931, when first brood adults emerged on 16th July. Individuals introduced into a cage enclosing a branch of nectarine had caused considerable injury by 23rd July, but oviposition had not occurred by that date.

Oil emulsions containing cresylic acid have been successfully used as delayed dormant sprays against Coccids and the eggs of red mite [*Paratetranychus pilosus*, C. & F.] and Aphids on apple [xx, 81], and investigations, discussed by J. M. Ginsburg (pp. 193–197), were carried out to determine the effect of the addition of a copper fungicide. In the laboratory, mixtures of 100 cc. tap water containing oil emulsion equivalent to 3 per cent. actual oil, 0·5 per cent. cresylic acid and fungicide (Bordeaux mixture or copper ammonium silicate) equivalent to 0·25 per cent. actual copper were allowed to stand in covered beakers for 4 hours, the stability of the emulsion being frequently tested. It was found that neither copper ammonium silicate nor Bordeaux containing 10 per cent. bone glue breaks up an emulsion containing cresylic acid; that Bordeaux without bone glue breaks up a soap emulsion containing no stabilising agent in the presence of cresylic acid but does not break it up in the presence of colloidal cresol; and that oil emulsified with powdered skim milk is compatible with cresylic acid, colloidal cresylic acid or colloidal cresol in mixtures containing copper ammonium silicate or Bordeaux with or without glue. Field tests showed that neither of the copper fungicides affected the toxicity of the oil to the eggs of *P. pilosus* or of the cresylic acid to those of the Aphids.

R. C. Burdette (pp. 197–199) reports that talc applied by a power duster was not so effective as a repellent against the pepper maggot [*Spilographa electa*, Say] on pepper [*Capsicum*] as when a hand duster was used. Poor results with the hand duster were due to the fact that insufficient material was applied to the lower surface of the leaves. In work on the effect of accumulation of soil temperature on the pupae, the threshold of development was taken at 46°F., and emergence was found to take place on the accumulation of approximately 1,350 day-degrees [*cf.* x, 479; xx, 275]. For pupae at a depth of 1½ ins. in the soil this occurred on 26th June, at 3 ins. on 3rd July, at 6 ins. on 4th July and at 10 ins. on 5th July. From a total of 5,200 pupae placed in the soil, only 1,000 adults emerged, the greatest number coming from the least depth. The Mexican bean beetle [*Epilachna corrupta*, Muls.] was exceptionally abundant early in 1931, owing to the fact that unusually large numbers had entered hibernation in 1930 and the winter had been mild. In experiments in control, magnesium arsenate proved more effective as a dust than as a spray. Dusts and sprays containing nicotine tannate gave some promise but could not be recommended as a substitute for magnesium arsenate.

The importance of high pressure in the application of sprays of pyrethrum against *Euscelis striatulus*, Fall. (blunt-nosed leafhopper), the vector of false blossom disease of cranberry, is stressed by C. S. Beckwith and C. A. Doehlert (pp. 199–205). In some cases as much as 1,000 ft. of hose is used to carry the solution from the sprayer to the plants on the bog, and this hose is usually as small as possible. The great loss in pressure in small hose is not generally realised. A table is given showing the reduction in pressure per 1,000 ft. of ½, ¾ and 1 in. pipe at various rates of discharge. The amount of pressure may be increased by the use of a larger hose or a smaller disk in the nozzle. In the original experiments [xviii, 352], 200 lb. pressure was used at the nozzle, and excellent results were obtained from the use of a spray of pyrethrum soap or pyrethrum and penetrol. At a lower pressure the former combination proved the more effective.

An account is given by C. C. Hamilton (pp. 205–227) of investigations on insect pests in greenhouses. The adults of the weevil, *Diorymerellus laevimargo*, Champ., cause serious damage to the buds and flowers of orchids, though they are usually to be found sheltering just below the surface of the peat in which the plants are grown, where they feed on the roots to some extent. Control measures have consisted principally of hand-collection during the forcing season, which has not proved effective, and the application of a strong spray of soap and nicotine, which when tested did not prove toxic but merely stupefied the weevils for a short time. As a result of extensive experiments on the effect of numerous substances on the roots of orchids, on the peat and on the weevils, paradichlorobenzene was found to be the most satisfactory, treatment for 24 hours with 4 gm. scattered uniformly over the peat in 4-inch pots resulting in 95–100 per cent. mortality. A dose of 2 gm. was sufficient to produce a satisfactory kill. The effect was more rapid at an average temperature of 75–80°F. than at 65°F.; at the lower temperature some of the weevils crawled on to the stems. *Aspidiotus hederae*, Vall. (orchid scale) is found at the crown and beneath the stems of the plants, from which it is usually removed twice a year by means of a brush, spray materials having proved unsatisfactory. Preliminary experiments with a mixture of 1 part paradichlorobenzene to 9–10 parts coarse sawdust,

one or two handfuls of which were placed round the bases of the plants, gave indication of good results.

Mealybugs on *Gardenia* constitute a serious problem; the rather dense foliage and quick growth appear to intensify infestation. The species most commonly found is *Pseudococcus citri*, Risso, which is often attended and distributed by ants. Young potted plants that were treated 3 or 4 times at weekly intervals with a spray containing 5 per cent. coconut fatty acid soap and 0·25 per cent. free nicotine (40 per cent.), and were dipped in the same material prior to setting out, remained comparatively free from infestation. The cockroach, *Periplaneta americana*, L., was abundant in certain greenhouses containing gardenias, causing some damage to the flowers and leaves. It was readily killed by a poison bait of bread crumbs mixed with 3–4 per cent. sodium fluosilicate or sodium arsenate and sufficient water to form a damp mash.

Large numbers of small white mites were found attacking *Ardisia*, injury usually occurring at swellings on the roots caused by the Nematode, *Heterodera radicola*, Greeff, or at roughened or slightly protected places. Their feeding resulted in the death of the plant tissues and the breaking off of the infested part. They were distributed from near the surface to the bottom of the pots in which the plants were growing, a depth of approximately 2½ ins. Of various materials tested against them, paradichlorobenzene was the most effective, the application to each plant of about 20 gm. of a mixture of 1 part to 9 parts potting soil giving 75–80 per cent. control with no signs of injury.

Work on the control of wireworms is discussed by R. C. Burdette (pp. 227–238). The use, prior to the planting of the main crop, of a trap crop of maize and the treatment of each hill of germinating maize with 1 qt. carbon bisulphide emulsion, containing 1 oz. carbon bisulphide, proved fairly effective. Tests indicated the possibility of reducing the amount of carbon bisulphide by the addition of pyrethrum extract.

C. C. Hamilton in discussing the effects of various spray materials on ornamental evergreens (pp. 251–253) states that considerable care should be taken in applying oil sprays to such plants, particularly junipers.

Sorenson (C. J.). **Insects in Relation to Alfalfa-seed Production.**—*Circ. Utah Agric. Expt. Sta.*, no. 98, 28 pp., 7 figs., 5 refs. Logan, Utah, April 1932. [Recd. October 1932.]

Insect pests are suspected of being responsible for the unsatisfactory yields of lucerne seed in Utah, and investigations were begun in 1926 to determine the relation of certain insects to seed production and to develop methods for their control. The information on *Bruchophagus funebris*, How., has already been noticed [*R.A.E.*, A, xix, 18]. The Capsids, *Lygus pratensis*, L., and *Adelphocoris superbus*, Uhler, which cause a certain amount of flower drop [xx, 534], are present in the fields from April till the occurrence of frost in the autumn; the eggs are laid in the upper 3–4 ins. of the stems, and there are 3–4 broods in a season. No satisfactory method of control is known, but infestation may be prevented to some extent by the destruction of weeds, rubbish, etc., liable to shelter hibernating individuals. *Frankliniella occidentalis*, Perg., is very numerous in lucerne fields, particularly in the first growth that is left for seed, and there is some

indication that this thrips causes appreciable loss of seed. The adults overwinter under crop refuse and in other protected places in the field. Oviposition begins in April–May, the eggs being laid in the tissues of the leaves and stems of lucerne, and 8–10 broods occur during the growing season. Two applications with an interval of a week of nicotine sulphate in spray or dust form are recommended for control. The hibernating quarters may be destroyed by clean cultivation, and the eggs may be killed by cutting the crop for hay.

The Aphid, *Macrosiphum* (*Illinoia*) *pisi*, Kalt., was present in fields during the investigations but, except in one county in 1929, it does not appear to have caused any great damage. Parthenogenetic reproduction is prolific and rapid from spring to autumn, 10–12 broods being produced. In the autumn, males and oviparous females appear, the overwintering eggs being laid on the leaves and stems of lucerne. The rate of increase is greatly influenced by climatic conditions, particularly in the spring, when warm, dry weather is unfavourable, chiefly owing to its activating effect on natural enemies. In experiments in which Aphids were caged over flowers in ratios of 5, 10 and 20 to 100, the losses in pod production due to the fall of the flowers were 33·33, 69·44 and 89·55 per cent. respectively, compared with the pods produced on uninfested stems. The ratio of Aphids to flowers in the field was estimated at less than 5 : 20. Control measures [xvi, 204] should be applied when patches of unhealthy, light-coloured plants first appear in the spring. Under some conditions, harrowing followed by dragging destroys the Aphids. In experiments in 1931, 4 and 6 per cent. home-made nicotine dust gave fairly satisfactory control of a light infestation. In cases of severe attack, harvesting the crop usually prevents further injury.

Adults of *Epicauta sericans*, Lec., were present in considerable numbers on lucerne in early summer, though not sufficiently abundant to cause serious injury. They fed voraciously on the first flowers, frequently destroying the petals and ovaries, but when blossoms became more abundant they fed lightly on the edges of the petals, causing little or no damage. The larvae feed exclusively on the eggs of grasshoppers, but it is doubtful whether this advantage offsets the damage caused by the adults. Control measures suggested include a dust of sodium fluosilicate and hydrated lime [xiv, 12]. Calcium arsenate dust had no apparent effect on the beetles in experiments in 1931.

Damage by *Hypera variabilis*, Hbst. (*Phytonomus posticus*, Gyll.) increased during the investigations, resulting in severe injury in all areas in 1931. Calcium arsenate at the rate of 2 lb. to the acre gives satisfactory control; in experiments a dust of 50 per cent. calcium arsenate and 50 per cent. dusting sulphur applied at the rate of 5 lb. to the acre resulted in the death of approximately 90 per cent. of the larvae within a week, and about 96 per cent. after two weeks. The dust should be applied after the eggs have hatched and before the crop is seriously damaged. Destruction of the overwintering quarters by clean cultivation of the field in autumn may prevent damage to some extent, and cultivation in spring will stimulate early and vigorous growth, which may enable the plants to outgrow damage. As a result of the general dry conditions, grasshoppers have become progressively more abundant in most of the lucerne-seed areas of the State and have caused unusually severe damage annually; the usual recommendations for their control are given.

Wellman (F. L.). **Celery Mosaic Control in Florida by Eradication of the Wild Host** *Commelina nudiflora.*—*Science*, lxxvi, no. 1974, pp. 390–391, 3 refs. New York, 28th October 1932.

Successful control of a mosaic disease of celery (*Apium graveolens*), the virus of which is transmitted by *Aphis gossypii*, Glov., is recorded from Florida by eradication of the weed, *Commelina nudiflora*, which is a reservoir of the disease.

Davis (J. J.). **Insecticides and their Uses.**—*Bull. Purdue Univ.*, xxxii, no. 7 (Pharmacy Ext. Ser. i), 56 pp., 6 figs., 1 ref. Lafayette, Ind., March 1932. [Recd. October 1932.]

This bulletin, which has been compiled to enable the retailer in insecticides in Indiana to co-operate more effectively with the consumers, gives information on the practical application of insecticides and discusses the individual materials according to their mode of action. An appendix deals briefly with the habits and control of the common insect pests.

Service and Regulatory Announcements April–June 1932.—*U.S. Dept. Agric., P.Q.C.A.*, S.R.A., no. 111, pp. 28–49. Washington, D.C., September 1932.

Recent revisions and amendments to existing quarantine orders of the United States, which are given verbatim, include an announcement (P.Q.C.A. 333) relating to the Japanese Beetle [*Popillia japonica*, Newm.] Quarantine (No. 48), supplementary to instructions to inspectors for the disinfection of nursery plants, which gives instructions for the disinfection with miscible carbon bisulphide emulsion of the soil round the roots of plants about to be transplanted [*cf. R.A.E.*, A, xviii, 355]. A collar of galvanised iron 10 ins. wide is placed round the plants and forced down to a depth of 3 ins. The soil, from which all weeds and débris have been removed, is carefully firmed on each side of the metal, and the emulsion is poured into the collar. The collar and soil must not be disturbed for 48 hours, and the plant must be dug up 2–5 days after treatment, no soil outside the collar being removed with it. Tables are given showing the degree of dilution of miscible carbon bisulphide required at different temperatures and the quantity to be applied according to diameter, or length of side, of circular or square collars. Treatment should not be applied unless the minimum soil temperature at a depth of 6 ins. remains above 40°F. The quantity of 50 per cent. miscible carbon bisulphide used to 10 U.S. gals. water (which is the amount required for a square collar with a 24 in. side or a circular one 27 ins. in diameter) is 68 cc. at a soil temperature at this depth of 40–50°F., 57 cc. at 50–60°F. and 45 cc. at above 60°F. The surface of the soil round the base of the plant to be treated must be level, and the treatment must not be applied where the ground has a slope of more than 1 inch in 10, special care being taken on ploughed and stony land to prevent loss of the liquid. An examination of the soil must be made by digging to a depth of at least 12 ins. outside the collar to determine whether a hardpan of clay, rock formation, high water table or other unfavourable condition is likely to hinder proper penetration. If the liquid disappears from the surface in less than 10 minutes, or fails to

do so in 5 hours, the treatment will not be successful. An examination must be made during the treatment and after the liquid has disappeared to determine the uniformity of penetration.

A Press Notice issued on 14th June 1932 stated that the pink bollworm of cotton [*Platyedra gossypiella*, Saund.] had recently been found for the first time in southern Florida. Infestation was discovered in a small patch of cultivated cotton near Miami and in wild cotton in a section south of Miami extending to Key West, the region being about 400 miles distant from commercial cotton plantings. *P. gossypiella* has heretofore been found in the United States only in the south-west. The only infestation in the main cotton belt consisted of an extensive outbreak in south-western Louisiana and south-eastern Texas lasting from 1916 to 1921. This was eradicated 10 years ago, and the insect has not since been found in that region. The infestation in Mexico, however, extends northwards into western Texas, New Mexico and Arizona, where cotton is grown in certain irrigated sections. Measures are being taken in Florida to prevent the spread of *P. gossypiella*, but it is considered that quarantine action at the present time is not necessary.

Lehman (R. S.). **Experiments to determine the Attractiveness of various aromatic Compounds to Adults of the Wireworms** *Limonius* (*Pheletes*) *canus* **Lec. and** *Limonius* (*Pheletes*) *californicus* **Mann.**—*J. Econ. Ent.*, xxv, no. 5, pp. 949–958, 1 pl. Geneva, N.Y., August 1932.

In connection with investigations of wireworms in the north-western United States, the attractiveness of some 150 essential oils and aromatic compounds to the adults of *Pheletes* (*Limonius*) *canus*, Lec., and *P.* (*L.*) *californicus*, Mann., was tested in the laboratory, and 14 of the most attractive compounds were subsequently used in traps in the field. The results of the laboratory tests are shown in tables. The field experiments bore out the indications in the laboratory that butyric, caproic and lactic acids are sex attractants. Valeric acid was also found to be a sex attractant.

The beetles first appeared on forced rhubarb on 20th March 1931. Traps on the surface of the ground at first contained most beetles, but later, when they became more active, the greater numbers were attracted to those 3 and 6 ft. above the ground. The majority of the beetles were caught in rhubarb fields, where they feed on the flower heads, but a large number were also obtained in a cherry orchard where spinach was growing. Since the majority of the beetles caught in traps were males, and these represented only a small percentage of the total present in the field, the traps cannot be considered a means of control, and the investigation will be continued in the hope of finding better attractants.

Lane (M. C.) & Gibson (K. E.). **Carbon Disulphide as a Control for Wireworms.**—*J. Econ. Ent.*, xxv, no. 5, pp. 958–967, 1 pl., 2 figs. Geneva, N.Y., October 1932.

The following is taken from the authors' summary : The results of several seasons' work in Washington State with carbon bisulphide as a soil fumigant in fields infested by wireworms are reported. Data are presented to show that carbon bisulphide can be used as an efficient control for wireworms in the soil under certain conditions. These

conditions are a loose, damp soil, a diffusion distance of 17 inches or less, and a dose of at least 1 oz. A good kill was obtained by placing doses of 1 fl. oz. in holes 4 ins. deep and 18 ins. apart, and fair control by spacing the same doses 24 ins. apart. For the best diffusion of the carbon bisulphide in the surface layer, the soil should be prepared by ploughing.

CAMPBELL (R. E.) & STONE (M. W.). **The Effect of Sulphur on Wireworms.**—*J. Econ. Ent.*, xxv, no. 5, pp. 967–970, 1 ref. Geneva, N.Y., October 1932.

Two sets of field tests carried out in southern California from 1926 to 1930 have shown that sulphur applied to the soil in quantities up to 1,000 lb. per acre per year has little or no effect on wireworm damage or population, although a decided increase in the acidity of the soil is maintained during that period [*cf. R.A.E.*, A, xvi, 327]. The sulphur was applied with a fertiliser drill and ploughed under. Both spring and autumn crops of potatoes were grown each year during the first experiment, and a crop of potatoes was planted in April and harvested in August in the second. Sacks of potatoes were examined from each plot to determine the number of wireworm punctures, and electrometric pH determinations were made of soil samples taken from the various plots at the same time. It has been shown that *Pheletes* (*Limonius*) *californicus*, Mann., which was the wireworm concerned in the tests, reaches maturity during the third summer of its larval life, so that it may be concluded from results obtained over a period of four years that repeated applications of sulphur do not materially reduce injury caused by it to potatoes grown in infested soil.

LARSON (A. O.) & HINMAN (F. G.). **Insects found on Pea Fields in the Willamette Valley, Oregon, after Harvest.**—*J. Econ. Ent.*, xxv, no. 5, pp. 971–976, 1 ref. Geneva, N.Y., October 1932.

In order to ascertain the effect of burning pea stubble, etc., one of the methods recommended for the control of the pea Bruchid [*Bruchus pisorum*, L.] in the Willamette Valley, Oregon [*R.A.E.*, A, xix, 578], it was necessary to know the numbers and kinds of insects present in pea fields after harvest. Insects found on 78 plots, each 10 ft. square, in 20 fields in widely separated parts of the valley were collected and counted. The surface of the ground was thoroughly inspected, and straw and litter were carefully examined and removed. It was found that many of the insects left the fields within a few days after the crop had been removed. A classified list of the species obtained is given. It is roughly estimated that of the species other than *B. pisorum*, 76 per cent. were injurious, 22 per cent. beneficial and 2 per cent. of unknown economic status. Nearly two-thirds of the insects collected were Coleoptera, and half of these were the very injurious *Diabrotica soror*, Lec., which was found to be generally distributed all over the valley. The Tenebrionid, *Blapstinus gregalis*, Csy., was also much in evidence, and the weevil, *Sitona hispidula*, F., although not so generally distributed, was numerous on one plot.

If the pea stubble were burned immediately after harvest, practically all the remaining Bruchids would be killed, each day that burning is put off increasing the numbers that emerge and escape, as well as the number of other injurious insects that migrate from the fields and escape destruction.

Webster (R. L.). **Injury and Distribution of Potato Flea-beetle in Washington.** *Epitrix cucumeris* **Harris,** *Epitrix subcrinita* **Leconte.** —*J. Econ. Ent.*, xxv, no. 5, pp. 976–980. Geneva, N.Y., October 1932.

Injury by flea-beetles to potato tubers and sometimes to foliage has caused considerable loss in western Washington during the past six years. In areas where severe injury to tubers occurs, *Epitrix cucumeris*, Harr., is the predominant species, damage being of little consequence in areas where it is absent. *E. subcrinita*, Lec., which is common throughout the State, although unknown in the eastern United States, is the only species collected from potato fields in eastern Washington [*cf. R.A.E.*, A, xix, 656, etc.]. Although the larvae of *E. subcrinita* feed mainly on the roots of the potato plant, the tubers are also liable to attack in some cases. The distinguishing external characters of the two species, which have often been confused, are indicated. Counts of more than 40,000 beetles show that the relative abundance of the two species varies greatly in different areas. *E. cucumeris* appears to be extending its distribution in western Washington.

List (G. M.) & Davis (L. G.). **The Use of** *Trichogramma minutum* **(Hymenoptera Chalcididae) Riley in the Control of the Codling Moth in Colorado.**—*J. Econ. Ent.*, xxv, no. 5, pp. 981–985. Geneva, N.Y., October 1932.

Certain problems arise in the breeding of *Trichogramma minutum*, Riley, in Colorado, owing to the dry climate of this State. It has been found that the length of life, vigour and productiveness of the adults are greatly increased by certain feeding methods. Water and certain sweetened liquids are beneficial, but it is difficult to supply them without drowning many of the parasites. The most convenient and satisfactory food is a raisin, which when exposed in air having a relative humidity of about 70 per cent. becomes soft and slightly sticky. *T. minutum* feeds readily on raisins in this condition, with the result that the normal length of life (about 3 days in the authors' work) is more than doubled, and activity and reproductiveness are correspondingly increased. The effectiveness of adults liberated in orchards might also possibly be greatly increased by feeding before liberations were made.

Accounts are given of a number of liberations of *T. minutum* in Colorado in 1930 and 1931 against the codling moth [*Cydia pomonella*, L.]. Both types of liberation were used, *viz.*, mass liberation, which aims at having parasites present at all times in sufficient numbers to destroy the eggs of *C. pomonella* as they are laid ; and colonisation, whereby single or infrequent liberations of varying numbers are made in the hope that the parasite will become established and increase sufficiently to be of value [*cf. R.A.E.*, A, xix, 97]. The results varied in different orchards with both methods, but it is concluded that during years in which natural parasitism is high the liberations show little benefit, and during years in which it is low the liberations may be responsible for pronounced parasitism, but the ultimate control as indicated by fruit counts is not marked. As there are several strains of *T. minutum* that behave quite differently in the laboratory and are probably just as distinct in the orchard, further study should be devoted to this side of the problem, as well as to all the orchard hosts of the parasite. In Colorado *T. minutum* continues to breed later than *C. pomonella*, so that it is obliged to seek other host eggs. The presence of suitable

later host eggs may therefore be as important as climatic factors in determining the overwintering of the parasite, and the control of this factor by means of cultural methods or cover crops may give more pronounced results than rearing and liberations.

Newcomer (E. J.) & Rolfs (A. R.). **Notes on the Biology of the Pear Leaf Blister Mite in the West.**—*J. Econ. Ent.*, xxv, no. 5, pp. 985–988, 3 refs. Geneva, N.Y., October 1932.

In view of the discrepancy between the statements regarding the biology of *Eriophyes pyri*, Pgst. (pear-leaf blister-mite) in older works on economic entomology and its actual habits as observed in the western United States, studies of the mite have been carried out in Washington from the time of hibernation until the fruit is set. In addition to the eastern form of *E. pyri*, which must almost certainly have been introduced into the west in dormant nursery stock, there appears to be, at least in the Pacific North-west, a form that is apparently indigenous on wild snowberry (*Symphoricarpus racemosus*) and that attacks apple, but not pear [*R.A.E.*, A, xiii, 328].

Observations recorded by other workers on the habits of the mites in the west are quoted [xiii, 328; xvi, 253; *cf.* also xvii, 73, 228; xx, 584]. Whereas it appears to be generally agreed that, in the east, the adult mites, which have wintered under the bud scales, burrow into the unfolding leaves from under the sides, that their feeding within the leaves causes blisters and that the eggs are laid within the blisters, the authors have found that in the west the wintering mites deposit eggs in the buds and die. The larvae from these eggs develop in the buds, and as they mature their external feeding on the lower surfaces of the leaves apparently causes the blisters to form. The adult mites of the first spring generation burrow into these blisters and deposit eggs within them, and subsequent generations appear to develop within the blisters. New blisters begin to appear on the young leaves about 1st June, and there are always considerable numbers of mites feeding externally. Eggs found within the blisters in April immediately after adults of the spring generation had entered them hatched several days later. As many as 5 mites and 40 eggs were found at one time in a single blister shortly after blisters were first formed. Whereas in the east the mites are said to burrow into the leaves very early, so that lime-sulphur sprays must be applied while the trees are still dormant, in the west sprays applied as late as the " cluster-bud " stage appear to be effective [*cf.* xx, 408]. On 5th May infested trees were sprayed experimentally with dormant strength lime-sulphur. Considerable damage was done to the foliage, but observations made 3 weeks later showed very few living mites on sprayed trees as compared with unsprayed. However, mortality was not complete and much damage had been done by the mites before the spray was applied. Such a late application cannot therefore be recommended, even though there were no injury from the spray itself.

Dozier (H. L.). **The Sicilian Mealybug Parasite in Illinois.**—*J. Econ. Ent.*, xxv, no. 5, p. 990. Geneva, N.Y., October 1932.

Tanaomastix (*Leptomastidea*) *abnormis*, Gir., which was introduced from the Mediterranean region into California in 1914 against *Pseudococcus citri*, Risso, and sent from there to Florida in 1917, was discovered in numbers parasitising *Phenacoccus gossypii*, Towns. & Ckll. (Mexican

mealybug) at Urbana, Illinois, on 29th April 1932. *P. gossypii* was first observed in Illinois in a greenhouse in 1928 and has since become one of the most serious greenhouse pests. The wide distribution and utilisation of *T. abnormis* against both species of mealybug, wherever present under glass, would appear to present no special difficulty.

Strand (A. L.). **Some Remarks on the physiological Action of Oil Sprays.**—*J. Econ. Ent.*, xxv, no. 5, pp. 991–994, 5 refs. Geneva, N.Y., October 1932.

Outstanding work dealing with the physiological action of oil sprays is reviewed from 1903 onwards, and the probable future trend of such work is indicated, special emphasis being placed on the study of the oxidation-reduction systems in plant and animal tissue.

Robinson (R. H.). **Water-soluble Arsenic in Oil Emulsion - Lead Arsenate Combination Sprays.**—*J. Econ. Ent.*, xxv, no. 5, pp. 995–1001. Geneva, N.Y., October 1932.

The following is the author's abstract: Laboratory studies of oil emulsion-lead arsenate combination sprays with distilled water as a diluent reveal that excessive amounts of water-soluble arsenic are liberated by chemical reaction. When alkaline spray waters are used in preparing the mixture, the amount of water-soluble arsenic is increased materially; in one water as much as 25 per cent. of the total arsenic of the lead arsenate had changed to the soluble form. In order to prevent severe foliage injury as much as possible, the use of hydrated lime is recommended to reprecipitate the soluble arsenic as basic calcium arsenate.

The following procedure is recommended for the preparation of a tank of combination spray: Add the required amount of oil emulsion to the tank and, with the agitator going, run in the water, whereby the emulsion, if a fairly thick jelly, is brought to a creamy consistency without lumping. When the tank is about three parts full, add 8–16 oz. high-grade hydrated lime for each 100 U.S. gals. of spray, increasing the lime where the water is strongly alkaline or is high in chlorides. Just before beginning to spray, the lead arsenate should be sifted in, and the tank sprayed out as rapidly as possible. It is preferable to stir the lead arsenate into a small amount of water before adding to the tank. A film of water thus surrounds each particle of lead arsenate and seems to slow up the reaction slightly.

Penny (D. D.). **The Effects of Oil Spray on the Navel Orange.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1002–1007. Geneva, N.Y., October 1932.

An account is given of a total of 350 separate tests with oil sprays over the period 1924 to 1931, inclusive, in experimental plots in a 15-acre grove of navel oranges in California. The effects of different strengths of various oils applied at different seasons were studied, as well as the influence of different emulsifiers on the character of the oil film deposited. After a record of 9 years' spraying the grove shows a normal increased yield with generally excellent vegetative condition. As compared with 9 fumigated check trees, the sprayed trees show more vegetative stimulation and more complete scale control. Severe infestations of black scale [*Saissetia oleae*, Bern.] present when treatments started have been reduced greatly, and subsequent spray treatments have kept this scale and red spider [*Paratetranychus citri*, McG.]

under satisfactory control. It was observed that oil sprays applied in late spring and early summer caused abnormal shedding of fruit and foliage, whereas applications later in the summer gave normal reactions. In 1927 a very pronounced suppression of bloom followed autumn applications of heavy oil, whereas light oil of 55 seconds viscosity put on at the same time has seldom had this effect. The fruits produced from trees affected with bloom suppression were considerably reduced in number, but increased in size to such an extent that the number of boxes obtained from trees in plots with reduced bloom was equal to the number from trees in plots not so affected.

Observations in 1932 after an experiment to determine the amount of dead wood caused by oil sprays in 1929, 1930 and 1931, in which one plot was fumigated and another sprayed with a 1·66 per cent. dilution of a 70 seconds viscosity oil, showed no difference in the amount of dead wood in the two plots. Severe damage of this type is, however, sometimes caused by over oiling. Not only the formation of dead wood, but also severe defoliation and suppression of bloom in the following year were caused by an excessive dose of 2 per cent. dilution of 100 seconds viscosity oil, applied at the rate of 50 U.S. gals. of spray to each tree. Very light oils in rather high doses failed to cause over-oiliness in any type of emulsion. From the standpoint of economy, it would seem advisable to use emulsions of the quick-breaking type, which deposit a large part of their oil on the tree, but from the standpoint of injury, it would appear better to use emulsions that spread the oil thinly and uniformly over the tree, even though much of the oil is lost by running off the tree. Tests of various emulsifiers showed decided advantages in favour of fish-oil soap emulsion, which deposits an unvarying light film of oil and at the same time thoroughly wets rough bark and other surfaces usually wetted only after prolonged application of spray. The heavy oil applied in this type of emulsion showed little penetration into the foliage and fruit, and late applications of this oil in soap emulsions gave no bloom suppression. In years of rather heavy bloom, summer applications of the 100 viscosity oil resulted in an excellently balanced condition of blossom and foliage, whereas the light oils produced the more normal, weaker bloom, with a greater proportion of blossoms to foliage. In most years trees sprayed annually in February with 2 per cent. heavy oil showed less vegetative stimulation and less influence of the oil on the bloom than did trees of the summer sprayed plots.

Observations on the control of red spider showed that oils of 65 seconds viscosity or heavier were necessary to kill the eggs. An oil of 65 seconds viscosity was found to give good control of both mites and *S. oleae*, but showed only to a limited extent the effect of improved vegetative state resulting from the use of oils of 100 seconds viscosity. Production records of the grove from 1922 to 1932 show normal fluctuations in yield from year to year with a definite tendency to increase in the later years, and no evidence of decreasing tolerance of the trees for oil sprays or of general deterioration.

EBELING (W.). **Experiments with Oil Sprays used in the Control of the California Red Scale, *Chrysomphalus aurantii* (Mask.) (Homoptera : Coccidae) on Lemons.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1007–1012, 1 chart, 1 ref. Geneva, N.Y., October 1932.

The results are presented of a series of experiments carried out in 1930 and 1931 in California to determine the effectiveness of oil sprays in the

control of *Chrysomphalus aurantii*, Mask., on lemon trees. The following is the author's abstract: Data are given indicating that the effectiveness of oil sprays is proportional to the heaviness of the oil and the percentage of the oil used in the spray, and inversely proportional to the amount of spreader used in the spray. Within the range of sulphonation of the oils used in the tests, no significant difference in insecticidal efficiency of the sprays was caused by difference in sulphonation of the oils. Injury to foliage was proportional to the heaviness of the oil and the percentage of oil used in the spray, and inversely proportional to the amount of spreader used and the sulphonation of the oil.

CHILDS (L.) & GILLESPIE (D. G.). **Production and Spread of the Woolly Aphis Parasite, *Aphelinus mali*, in the Hood River Valley.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1013–1016. Geneva, N.Y., October 1932.

From an initial introduction of 550 individuals of *Aphelinus mali*, Hald., from Michigan in 1929 [*R.A.E.*, A, xix, 90], a total of 92,000 have been reared and liberated in the Hood River Valley and other points in Oregon, where the parasite is now thoroughly established in over 40 orchards and is spreading rapidly. In most instances it is liberated in the adult stage. Details are given of the methods used in rearing, collecting and liberating the parasites. Apple trees were enclosed in frames covered with muslin and infested with *Eriosoma lanigerum*, Hausm., care being taken to ensure that the hosts were as free as possible from predators. As soon as a tree was covered with the Aphids, 1,000–2,000 adult parasites were introduced. Parasitism increased slowly at first, but accelerated towards the end of the first summer until in August the collection of 500 parasites a day did not appear to affect the numbers.

To determine the degree of control of *E. lanigerum* secured, a comparison was made in the autumn of 1930 between the Aphid population in two orchards where the first parasite liberations had been made in 1929 and that in nine other orchards where no parasites had been liberated. The average infestation of *E. lanigerum* was over 2½ times as high in the nine orchards as in the two orchards with parasites. The seasonal history of *A. mali* has been closely followed for two seasons, showing 8 complete generations in 1930 and 9 in 1931. There has been constant overlapping of generations in the orchard, and a difference as great as 20 days has been observed in emergence of adults maturing from eggs laid on the same day.

SCHOPP (R.) & DOUCETTE (C. F.). *Liothrips vaneeckei* **Priesner, a recently discovered Pest of Lily Bulbs.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1016–1019, 5 refs. Geneva, N.Y., October 1932.

The finding of *Liothrips vaneeckei*, Priesn., in lily bulbs in Oregon and Washington in 1930 and 1931 prompted an investigation on it. The present distribution of the thrips is discussed. Native bulbs of *Lilium washingtonianum* of considerable age growing in an isolated forest in Oregon have been found to be infested, and a decided preference for this species has been observed in commercial plantings. Several other species of *Lilium*, chiefly North American, were also attacked, but *L. regale* seems to be immune. The thrips appears to live and feed only between the scales of lily bulbs, except in one instance in

which it was intercepted on an orchid from Ceylon. The means of spread has not yet been determined, beyond migration from bulb to bulb in storage. Direct injury caused by the feeding of the thrips, which is apparently confined to the epidermal cells, does not seem to be very great. All stages are briefly described. Some evidence of parthenogenesis was obtained. One female, reared through the larval and pupal stages in an individual cage at room temperature, in the course of 76 days of adult life laid 43 eggs, 11 of which hatched. The larvae were not reared to determine their sex. Life-history studies indicate that the female starts oviposition 8–10 days after emergence, lays eggs singly at the rate of one or two a day, and may live for a considerable period. The eggs adhere lightly to the surface of the bulb scale. The incubation period averaged 12 days, the maximum period in an isolated case being 25 days. The first and second larval instars averaged 11 and 13 days respectively, and there appears to be no prepupal stage. The pupal stage of 14 individuals ranged between 10 and 13 days.

LATTA (R.). **The Vapor-Heat Treatment as applied to the Control of Narcissus Pests.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1020–1026, 1 pl., 1 fig., 9 refs. Geneva, N.Y., October 1932.

Experimental work was inaugurated in 1930 in Washington State to determine whether the vapour-heat treatment used against the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] [*R.A.E.*, A, xviii, 22, 547 ; xix, 449] could be utilised against various insects and mites infesting narcissus and other bulbs. The treating room used in the tests was 12 by 12 by 8 ft. Outside and just above the room is the mixing or conditioning chamber, where steam and water are introduced into the air system. The walls of the room are double, the inside portion, which covers a layer of insulating board, being waterproofed with paraffin wax. The floor is of sheet metal, with a drain at the lowest point, and a false floor raised 6 inches above this is made with 1-inch spaces between the boards. The supports of the false floor diverge radially from the centre of the one wall, at which point air is taken from the room. This arrangement causes equal quantities of air from all parts of the room to be drawn through a vent that leads up this wall to the mixing chamber above.

In the mixing chamber the air from the room is conditioned by being drawn through steam and cold-water sprays. A large multivane fan at one end of the chamber forces the air through an opening in the ceiling, and a flat grid immediately below this opening disperses it evenly to all parts of the top of the room. The air in the room is displaced three times a minute. A thermostat in the air-stream entering the room regulates the steam-valve, thus maintaining an accurate temperature.

Although sufficient data are not yet available to warrant the recommendation of a definite period of treatment, it appears that two hours at 111°F. is the minimum requirement for control of *Eumerus* spp. and *Merodon equestris*, F. Control is also obtained of *Rhizoglyphus hyacinthi*, Boisd., and *Tarsonemus approximatus* var. *narcissi*, Ewing, two mites frequently found on narcissus. Bulbs treated at the optimum time during the dormant period were forced under glass and produced good flowers. The treatment in general benefits planting stock by causing more vigorous growth and added increase in weight.

Hutson (R.). *Dicerca divaricata* **as a Defoliator.**—*J. Econ. Ent.*, xxv, no. 5, p. 1026. Geneva, N.Y., October 1932.

Severe defoliation of maple trees by severence of the leaf petioles observed in Michigan on 23rd June 1932 was found to be due to the Buprestid, *Dicerca divaricata*, Say, which, in addition to being the only insect present in numbers on the trees at the time, was seen to produce the identical type of injury when caged with leafy maple branches. Spraying with an arsenical against these beetles gave negative results.

Carter (W.). **Border Plantings as Guard Rows in Pineapple Mealy Bug Control.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1027–1030, 3 pls., 4 refs. Geneva, N.Y., October 1932.

The accumulation of *Pseudococcus brevipes*, Ckll., on pineapple plants growing on the edges of fields adjacent to grasses, which serve as the source of infestation, and the gradual movement of the mealybugs into the field area have been shown to be definitely responsible for serious wilt disease of pineapples in Hawaii [*R.A.E.*, A, xix, 676 ; xx, 139, 606]. The planting of a strip of pineapple plants parallel to the edges of fields and separated from the main plantation by a road, a practice first adopted in consequence of a study of the movements of the mealybug to check its advance into pineapple plantations, is now proving essential to economical spraying by localising the area to be treated. Regular spraying of these borders has proved highly successful in eliminating the mealybugs as they first enter the field, and the practice has now been standardised.

The initial experiments indicated that the borders must not be less than 25 ft. in width and must be grown under the same conditions as the main plantation. One application of spray to guard rows costs less than 3*s*. 2*d*. (at par) to the acre even in areas where ratio of periphery to area is high.

Carter (W.). **Comparison of Tobacco Dust with other Forms of Nicotine in Control of Yellow Spot Disease of Pineapples.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1031–1035, 2 refs. Geneva, N.Y., October 1932.

The following is largely taken from the author's summary : Tobacco dust was tested together with 7 other forms of nicotine as a control measure against yellow spot, a recently described virus disease of pineapple in Hawaii transmitted by *Thrips tabaci*, Lind. [*R.A.E.*, A, xix, 648, 744]. The materials were applied, not primarily as insecticides, since it was recognised that no contact insecticide would be effective against so transient a visitor to pineapple plants as the thrips ; but on the hypothesis that the nicotine prevented the development of the disease. Approximately 50 U.S. gals. of spray or 60 lb. of dust were applied to the acre. The results clearly indicate the superiority of tobacco dust over the other nicotine applications. The incidence of the disease was conditioned by the growth and succulence of the plants, being lower in the poorly growing areas of the field. The reduced incidence in tobacco dusted plots is believed to be due to the changes induced in the plant as a result of the dust application.

Wall (R. E.). **Prediction of the Pale Western Cutworm Increase in Montana is fulfilled.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1043–1048, 2 figs., 5 refs. Geneva, N.Y., October 1932.

A general outbreak of *Porosagrotis* (*Agrotis*) *orthogonia*, Morr. (pale western cutworm) occurred in Montana in 1932 for the first time in 11 years, thus verifying the prediction made in 1931 on the basis of two years' precipitation records. Damage to approximately 140,000 acres of cereals was recorded in 26 counties in central and eastern Montana. It was estimated that the loss in infested fields would average 30 per cent. despite ideal conditions during May and June.

The development of the prediction method is discussed, with special reference to previous work on the weather relations of *P. orthogonia* and the probability of outbreaks in Montana [*R.A.E.*, A, xviii, 622; xx, 123, etc.]. A nearly linear relationship between total precipitation for the period 1919–1921 and the resultant change in abundance of the cutworm was indicated by an inspection of the tabulated data, and the critical point appeared to be 4 inches. With rainfall totalling less than 4 inches, an increase of *P. orthogonia* was recorded in the following season, but more than that amount produced a decrease. It is expected that an analysis of the new data on the relation of weather to increase and decrease in its abundance in 1931, 1932 and 1933 will permit of a further refinement of the forecasting method.

Farleman (M. G.). **Note on Cherry Fruit-fly Oviposition.**—*J. Econ. Ent.*, xxv, no. 5, p. 1048. Geneva, N.Y., October 1932.

Observations in Michigan of *Rhagoletis fausta*, O.S. (black-bodied cherry fruit-fly), which on 10th June 1932 was seen to make repeated vain attempts to oviposit in hard, unripe cherries, indicate that development and softening of fruit before ripening exert an influence on oviposition, so that the date for spraying against this Trypetid would appear to be not entirely dependent on the emergence of the fly.

Mail (G. A.). **Winter Temperature Gradients as a Factor in Insect Survival.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1049–1053. Geneva, N.Y., October 1932.

Figures relating to the degree of insulation against cold afforded by a covering of snow were secured during the winter of 1931–32 in Montana by means of thermocouples, not only inserted in the soil but extending at one inch intervals above it. An almost constant covering of snow was maintained over the instruments from 1st December to 31st March, and the average daily temperature during this period fluctuated between −25°C. [−13·F.] and 8°C. [46·4°F.], a difference of 33°C. [59·4°F.]. For this period the frost line, or depth to which the ground was frozen, did not go below 20 inches, and the minimum soil surface temperature was −4°C. [24·8°F.]. Under the blanket of snow, therefore, no soil hibernating eggs or insects were exposed to a greater degree of cold than 24·8°F., which previous studies have shown to be far above the lethal cold temperature for most of the economic species of insects.

Boyce (A. M.). **Mortality of** *Rhagoletis completa* **Cress. (Diptera : Trypetidae) through Ingestion of certain solid Materials.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1053–1059, 3 refs. Geneva, N.Y., October 1932.

Studies on the toxicity of various materials to adults of *Rhagoletis suavis completa*, Cress., begun in California in 1928, of which the results obtained in 1929 and 1930 have already been noticed [*R.A.E.*, A, xx, 175], were continued in 1931 subject to the same technique except that 20 per cent. sucrose instead of 10 per cent. was included for food in all tests. Basic lead arsenate, which is the form of arsenical used on walnut owing to the sensitiveness of the foliage to acid lead arsenate [*cf.* xx, 637], caused a discouragingly slow rate of mortality among the adults under laboratory conditions in 1928. It was therefore decided to determine whether or not the flies actually ingested the solid particles of the lead arsenate. Studies in which lead arsenate, barium fluosilicate, cryolite, copper carbonate, hydrated lime, talc, diatomaceous earth, bentonite, sulphur and ground tobacco leaves were employed, demonstrated that the flies actually take the undissolved particles into the stomach. Individual cage tests of each material, dyed with a non-water-soluble stain and applied on walnuts as spray and dust, were conducted. The materials were used undiluted except that 20 per cent. sucrose was included for food, and walnuts were treated with sucrose only as controls. Approximately 48 hours after treatment, lots consisting of 25 of the 50 flies included in each test were removed, stupefied with ether and dissected. In all tests 98 per cent. of the flies dissected had large quantities of stained material present in various portions of the alimentary canal, especially in the hind intestine.

Toxicity studies in 1931 consisted in determing the relative effectiveness of various materials in producing mortality in the flies. In addition to applications to walnuts in the form of dusts and sprays, the contact effect of the materials upon the body of the fly was tested. In these instances the flies were placed in a glass container and subjected to a dense dust cloud and were subsequently confined in a cage on walnut sprayed with stock sucrose solution. For several hours after treatment, the flies were constantly removing dust from their bodies with their legs, the fore-legs being usually cleaned with the mouthparts. In cases where volatile materials were used, screen cages were employed instead of glass to obviate a fumigating effect. All the diluent materials used (diatomaceous earth, talc, sulphur, bentonite and hydrated lime) demonstrated lethal action upon the flies. Various suggestions as to the nature of this action, which is unknown, are put forward. Of all the materials used, diatomaceous earth was the most rapid in its lethal action when applied directly to the bodies of the flies, producing mortality much more slowly when the flies fed upon it normally and still more slowly when mineral oil was incorporated in it. Talc, sulphur, bentonite and hydrated lime were also more rapid in their action when applied directly to the bodies of the flies, larger amounts being apparently ingested during the removal of the material from their bodies than through normal feeding. Basic lead arsenate exhibited relatively slow action in spray tests and was slower in producing mortality than in dust tests. A 40 per cent. dust mixture was somewhat slower in action than a 20 per cent. mixture, possibly owing to the increased amount of hydrated lime used in the latter as a diluent. Barium fluosilicate and synthetic cryolite (sodium fluoaluminate) on

the whole exhibited similar speeds of action. Fish oil incorporated with barium fluosilicate appreciably retarded its effect, although observation showed that it was not repellent to the flies. In tests with barium fluosilicate dusts the 40 per cent. mixture was slower in its action than the 20 per cent., a fact that is not readily explained. Natural cryolite was considerably inferior to synthetic cryolite in these tests. The nicotine compounds and mixtures tested were relatively slow in their action as stomach poisons.

It was observed that inverted battery-jar cages afford more nearly optimum conditions for longevity than do screen cages. Sucrose supplied as a spray induces greater longevity than powdered sucrose dusted on to the nuts. No deleterious effect was observed from dusting powdered sucrose directly on the bodies of the flies.

BLANCHARD (R. A.) & CONGER (C. B.). **Notes on *Prodenia praefica* Grote.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1059–1070, 2 refs. Geneva, N.Y., October 1932.

Prodenia praefica, Grote, all stages of which are described, has caused considerable damage periodically in California, Nevada and Oregon, the latest general outbreak having occurred in 1930. It has been found at elevations ranging from 50 to approximately 5,000 ft. above sea level. Lucerne is the principal crop attacked, although severe damage has been caused to other field and vegetable crops. A list is given of the plants on which the larvae have been observed to feed. Lucerne is usually injured by feeding upon the foliage, although seed lucerne is most seriously damaged through destruction of the flowering parts. In heavily infested fields the larvae gnaw the outer tissues of the stubble after it is cut, thus checking the new growth. Types of damage caused to other plants are also described. It appears that *P. praefica* prefers wild food-plants found in grazing areas, and that it is forced to attack lucerne during the summer by the drying up of the natural growth.

Observations indicate that in the vicinity of Sacramento there are three complete generations a year. Adults from pupae overwintering in lucerne fields and border lands, as well as larvae from eggs laid by these moths, were taken in grassland areas. In 1931 the first moths were observed in the field on 15th April, and full-grown first generation larvae were taken on 9th May in pasture land, feeding upon wild plants (*Erodium* and *Grindelia*). No larvae of the first generation were taken on lucerne. Second generation larvae were present from early June until late July, and those of the third from mid-July until early September. A partial fourth generation was indicated by 3 moths taken in traps on 3rd September. The eggs are laid in masses at night, usually on the upper surfaces of the leaves, and hatch in 3–5 days. The average length of the larval stage (including 6 or 7 instars) was 26·8 days for the second generation and 21·3 days for the third. The larger larvae showed a preference for prickly lettuce (*Lactuca scariola*), and when fed on it, grew more rapidly than those supplied with lucerne only. The young larvae spread by spinning silken filaments and swinging with the wind to other leaves. Dispersion is carried out by this means during the first 4 instars within an area of 50 sq. ft. of the point of oviposition, after which the larvae begin to move by their own locomotion. They remain normally inactive during the night and begin to move about 2 hours after sunrise. Migration and feeding of

the various larval instars are described. The mature larvae burrowed 1½–2 inches into the ground and entered the prepupal stage, which lasted 1–5 days. The pupal stage of the first generation averaged 18 days, and of the second 15·3 days ; two individuals of the third remained 16 and 31 days respectively in the pupal stage. All other larvae of this generation collected in the field remained in hibernation in the pupal stage.

A polyhedral disease affecting the larvae in the fourth instar was the most important factor in natural control, and a fungous disease killed a small percentage of the prepupae. *Chelonus texanus*, Cress., which oviposits in the egg of the host, was the most important Hymenopterous parasite observed. The host larva enters the soil and forms a small normal cell, and the parasite larva emerges 16–20 days after oviposition and spins a white cocoon in the soil. The adult parasite issues 8–12 days later. Larvae of *Hyposoter exiguae*, Vier., were observed in 1931 to emerge from the fourth instar larvae. Hymenopterous parasites reared from the pupae were *Ichneumon* (*Amblyteles*) *difficilis*, Cress., *Apanteles marginiventris*, Cress., *Cryptus tejonensis*, Cress., and *Meteorus vulgaris*, Cress. The Tachinid, *Archytas analis*, F. (*californiae*, Wlk.), was the most important Dipterous parasite, and perhaps the most important of all the species observed. The fly emerges from the host pupa. Other Tachinid parasites reared were *Eucelatoria armigera*, Coq., which issued from the pre-pupa, 1–7 developing in a single host ; and *Phorocera claripennis*, Macq. The Phorid, *Megaselia* (*Aphiochaeta*) sp., was reared from material collected near Plymouth, California, as many as 130 adults issuing from one larva. Predators included two species of birds, an undetermined ant and *Sinea diadema*, F. (spined soldier bug).

A table is given showing the results of a study to determine the relative importance of parasites and other factors in the control of *P. praefica*.

Control methods employed include cutting infested lucerne just before the damage becomes serious. Ploughing a furrow round a field to be protected checks migration of larvae from lucerne to beans, tomatos or other crops. Where the soil is hard and dry, two furrows afford greater protection, and poisoned bran mash may be spread in them. A line of heavy oil acts as a barrier when not allowed to become covered with dust, and irrigation ditches filled with water have also been used, still water being preferable to running water. Screen traps placed at intervals in swiftly running water have met with some success, but the removal of the larvae from them entails considerable labour. A spray of 4 lb. lead arsenate to 100 U.S. gals. water with 3 U.S. qts. molasses has been used with good results in fields of seed lucerne where cutting is impracticable. The larvae did not feed on bran baits scattered in the field, but invariably did so when the baits were spread in front of their line of advance in strips 3–4 ins. wide at intervals of about 3 ft., so that they were forced to cross them. Baits containing Paris green or sodium fluoride at the rate of 1 lb. to 25 lb. wheat-bran and 2 lb. molasses gave very good control in experiments, whereas sodium arsenite (½ U.S. pint) and white arsenic (1 lb.) gave poor results. Good control was obtained by dusting larvae in cages with calcium arsenate alone or mixed with equal parts of hydrated lime, and satisfactory results are reported from the use of pure calcium arsenate at the rate of 20 lb. an acre on tomato and similar crops.

HAEGELE (R. W.). **Some Results with Pyrethrum in the Control of *Mineola scitulella* Hulst (Lepidoptera, Pyralidae).**—*J. Econ. Ent.*, xxv, no. 5, pp. 1073–1077. Geneva, N.Y., October 1932.

Mineola scitulella, Hulst, has recently become important as a pest of prunes in south-western Idaho, where there are two generations and a partial third annually. Notes on the life-history of this Pyralid are taken from an unpublished manuscript by C. Wakeland. It overwinters as a partly grown larva in small wart-like hibernaculae on the tree. Larval emergence usually starts between 15th and 20th March and is completed early in April. The larvae at once bore into blossom buds, one larva being capable of destroying several buds. They become full-grown in 2–4 weeks, after which they drop to the ground to pupate. The moths begin to emerge about 15th May and continue to do so through June. The eggs are laid on the lower surfaces of the leaves, and the resulting larvae enter the green prunes, in the interior of which they feed. In about 3 weeks they leave the fruit, drop to the ground and pupate. The moths start to emerge in July, the eggs being laid as in the preceding generation and the larvae entering the ripening fruit. Here they feed for a short time before leaving the fruit to spin hibernaculae. A few second generation larvae, however, remain in the fruit until full-grown and produce a partial third generation.

Promising results were obtained with sprays containing pyrethrum in experiments in April to control the overwintered larvae in the buds. The materials tested were pyrethrum extracts used in combination with soap or emulsions of kerosene or dormant type oil, a pyrethrum-rotenone preparation, nicotine sulphate, nicotine, and lime-sulphur with or without lead arsenate. The best results were obtained with a kerosene extract of pyrethrum in a kerosene-soap emulsion spray, which gave a kill of 93 per cent. The larvae became highly active in the buds sprayed with this material, the activity ceasing in about 2 hours, after which time death occurred.

RICHARDSON (C. H.) & HAAS (L. E.). **The Evaluation of Stomach Poisons for Grasshopper Baits.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1078–1088, 1 graph, 11 refs. Geneva, N.Y., October 1932.

The following is the authors' abstract : Adults of *Melanoplus femur-rubrum*, DeG., and *M. differentialis*, Thomas, were fed determined quantities of bran, molasses and water bait which contained known concentrations of arsenious oxide, monosodium arsenite in solution, trisodium arsenite in solution, Paris green, acid lead arsenate, sodium fluosilicate or rotenone. The method is described. The estimated median lethal dose (M.L.D.) of arsenious oxide per gm. of body weight is 0·36 mg. For the sodium arsenites, Paris green and sodium fluosilicate, the M.L.D. is approximately equal and estimated to be about 0·16 mg. The M.L.D. for acid lead arsenate is >3·0 mg. and for rotenone probably >2·0 mg. For survival periods less than 96 hours, monosodium arsenite was more toxic than the other compounds. Under experimental conditions the grasshoppers were not repelled by the odour or taste of the bait mixtures used and ceased to feed only when they became satiated or were too sick to eat more. If undisturbed, they usually consumed a toxic dose of an active poison before leaving the bait.

COTTON (R. T.). **The Relation of respiratory Metabolism of Insects to their Susceptibility to Fumigants.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1088–1103, 6 figs., 11 refs. Geneva, N.Y., October 1932.

Evidence collected from the literature and confirmed by original work is presented to show the effect of differences in the rate of metabolism on the susceptibility of insects to the action of fumigants, and of certain factors influencing the rate of metabolism. Tests with carbon bisulphide on adults, larvae and pupae of *Tribolium confusum*, Duv., and *Ephestia kühniella*, Zell., confirm the findings of other workers that the rate of metabolism varies with the rate of the insect's development, the adult having the highest (and being the most susceptible to the fumigant), followed in order by the larva and pupa. The metabolic rates have also been shown to be widely divergent in different species of the same genus, and this may account for the fact that different species of a genus vary markedly in their susceptibility to fumigants. Adults of *Calandra* (*Sitophilus*) *oryzae*, L., are killed in 3 hours at 75°F. with a dosage of 9 mg. ethylene oxide per litre, whereas to kill adults of the less active *C.* (*S.*) *granaria*, L., under the same conditions 13·5 mg. is required. Experiments with adults of *T. confusum* at temperatures of 50°, 70° and 80°F. to determine the effect of temperature on their susceptibility to fumigants show that insects that have been kept at low temperatures do not respond readily to sudden changes in temperature, but retain for some time an added resistance to fumigants, this being unaffected by the temperature of the fumigation chamber. As heat penetrates most commodities slowly, the infesting insects would be unaffected by the heat of the chamber until it had thoroughly penetrated the materials. Hence all commodities taken from cool or cold storage should be allowed to warm up to at least 70°F. before being fumigated.

To test the effect of oxygen deficiency on the susceptibility of insects to fumigants, experiments were conducted with various species in a vacuum tank in which the oxygen content of the atmosphere could be regulated. The results indicate that all species are affected in the same way by oxygen deficiency, though possibly not to the same degree; that larval and pupal stages (but not the egg stage) are similarly affected; and that ethylene dichloride and other gases show an apparent increase in toxicity when used in combination with oxygen deficiency. A further experiment showed that oxygen deficiency and not the low pressure occasioned by holding a vacuum is the factor affecting the insects.

Additional work indicates that the increase in the rate of metabolism induced by increased concentrations of carbon dioxide [*R.A.E.*, A, xviii, 408] affect not only adult insects but also larvae and pupae. In mixtures with other gases the quantity of carbon dioxide needed to give the maximum insecticidal effect varied with the gas used. The maximum effect with carbon bisulphide was obtained in an atmosphere containing 15 lb. carbon dioxide to 1,000 cu. ft. of space, whereas with ethylene oxide 30 lb. and with chloropicrin 37 lb. carbon dioxide were required to obtain maximum efficiency. In an empty fumigation chamber, the toxicity of ethylene oxide to adults of *T. confusum* was increased approximately 4 times by the addition of carbon dioxide and that of chloropicrin $2\frac{1}{2}$ times. Probably the effect of the fumigants themselves on the insect tissues sometimes partly or wholly counteracts the action of the carbon dioxide. This is the case where the fumigant is hydrocyanic acid gas, which inhibits the respiratory process by preventing the tissues from taking up oxygen. It was found that the

toxicity of the fumigant was increased by carbon dioxide whether or not the chamber was filled with material, and that if it was filled with a highly adsorptive material a much greater toxicity was obtained with some fumigants than would be normally expected.

Experiments to determine the combined effect of increasing the carbon dioxide content and decreasing the oxygen content of the chamber showed that these two factors are more effective together than when either is used alone. If, however, the metabolic rates of the insects are decreased by holding them at a low temperature prior to fumigation, the effects of the other two factors are almost nullified. The three factors (warmth, carbon dioxide and reduced oxygen), therefore, are most effective when used together. The toxicity of ethylene oxide to adults of *T. confusum* is increased more than 6 times when these three factors are combined.

LEONARD (M. D.). **The Cottony Cushion-scale in Puerto Rico.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1103–1107. Geneva, N.Y., October 1932.

A brief account is given of the spread of *Icerya purchasi*, Mask., in Porto Rico since its first discovery there on rose bushes in February 1930 [*cf. R.A.E.*, A, xx, 401, 529]. The food-plants hitherto found infested in the Island are enumerated, the most favoured being *Citrus* and *Casuarina*. Pigeon peas [*Cajanus indicus*], which are widely grown in Porto Rico, are infested and are potentially an important food-plant. Infested grapefruit was sprayed with commercial oil emulsion without conspicuous success, and the most heavily infested branches were pruned and burned. Two shipments of *Rodolia* (*Vedalia*) *cardinalis*, Muls., were imported from Florida in April 1932 for release against *I. purchasi*, and by the beginning of July the Coccinellids had greatly reduced infestation in one grove of grapefruit and appeared to be well established in others. As many as 50 per cent. of the scales were found to be parasitised in some cases by the Phorid, *Syneura cocciphila*, Coq.; and *Chrysopa collaris*, Schn., which was the next most important enemy, the Coccinellid, *Cycloneda sanguinea*, L., and the Tineid, *Ereunetis minuscula*, Wlsm., were observed to be predacious on *I. purchasi*. A survey in August showed the scale to be less abundant than at any time since its discovery, the final suppression of the infestation being apparently due to a light grey fungus that had appeared in great abundance following wet weather.

HUTSON (R.). **Box Elder Bug on Strawberries.**—*J. Econ. Ent.*, xxv, no. 5, p. 1107. Geneva, N.Y., October 1932.

Leptocoris trivittatus, Say, was observed on 18th August 1932 in Michigan infesting perpetual strawberries, all stages being extremely numerous. The feeding of the nymphs on the foliage and fruit caused the loss of the entire crop and great apparent damage to the plants, many of which were killed outright.

HOLLOWAY (T. E.). **Hawaiian Parasite of Sugarcane Mealybug sent to Louisiana.**—*J. Econ. Ent.*, xxv, no. 5, p. 1107. Geneva, N.Y., October 1932.

Four shipments of *Pseudococcobius* (*Aphycus*) *terryi*, Fullaway, a parasite of *Pseudococcus boninsis*, Kuw., have recently been sent from

Hawaii for release in Louisiana. Parasitised mealybugs were sent in cold storage by ship to San Pedro, California, and thence to New Orleans by air mail. Every shipment arrived in good condition, and the parasites soon emerged in numbers. They proved easy to breed, although mealybugs were scarce at the moment of their arrival early in the season. Adults were released in Georgia in June. Other shipments have been previously released on two plantations in Louisiana on several occasions.

COLMAN (W.). **A Cage for Clothes Moth Larvae.**—*J. Econ. Ent.*, XXV, no. 5, p. 1108. Geneva, N.Y., October 1932.

Ordinary embroidery hoops 5 ins. in diameter and two slightly larger pieces of muslin constitute a simple means of confining larvae of *Tineola biselliella*, Humm., during toxicity tests of fumigants or moth proofing preparations. A piece of woollen material $2\frac{1}{2}$ ins. in diameter, on which 5–10 half-grown larvae have been allowed to establish themselves, is placed between the two pieces of muslin, which are then clamped together with the hoops. The number of larvae escaping from this cage is practically negligible, and it presents a large surface of muslin for the passage of gas or for aeration.

ESSIG (E. O.). **The California Tortoise Shell Butterfly.**—*J. Econ. Ent.*, XXV, no. 5, p. 1108. Geneva, N.Y., October 1932.

Vanessa (*Aglais*) *californica*, Boisd., which was unusually abundant in California during the summer of 1932, caused considerable damage in certain areas to *Ceanothus*, an important food for cattle. Larvae were first observed in the western foothills of the Sierra Nevada Mountains about the middle of May, and on 1st June 100 acres of *Ceanothus integerrimus* were completely defoliated. Adults were observed emerging in large numbers on 8th June, moving out of infested areas and seeking fresh plants at higher altitudes upon which to lay their eggs. On 13th June they had reached 7,500 ft., at which altitude larvae were observed in early July feeding on *C. cordulatus*. Adults of this generation appeared at the end of July and early in August. The gradual dispersal of these butterflies from the high altitudes to the lowlands caused considerable comment. *V. californica* frequently occurs abundantly in central and northern California, and dispersal flights have been observed in many localities during recent years.

VAN LEEUWEN (E. R.). **An experimental Corn Duster.**—*J. Econ. Ent.*, XXV, no. 5, pp. 1108–1110, 1 fig. Geneva, N.Y., October 1932.

A four-row maize duster, designed to improve on methods of application tested in experiments for the control of *Popillia japonica*, Newm., on maize by means of repellent dusts, gave very satisfactory results in tests conducted in 1931 in Pennsylvania. The work was done many times faster with it than with any other known method, and it was particularly efficient in distributing dust on the silk, the part of the plant most subject to attack. The duster is built up with a clearance of 5 ft. by means of a bent axle. The blower is traction driven, one horse being required to pull the machine. The horse, hopper and blower pass down the centre between two rows and the two wheels between these rows and the adjacent ones. There are 8 outlets, 2 to a row, each fastened on a boom to the rear of the duster, and so arranged

that each row or hill of maize is dusted from two sides. Dust was applied at the rate of 100 lb. to the acre, and three applications at intervals of 3 days were necessary to protect the maize. The cost of the machine is approximately £45 (at par).

SMITH (F. F.). **The natural Protection of *Gladiolus* Cormels from Thrips Attack.**—*J. Econ. Ent.*, xxv, no. 5, p. 1110. Geneva, N.Y., October 1932.

Observations on *Taeniothrips gladioli*, Moult & Steinw., in connection with its control on *Gladiolus* showed that the thrips breed during the winter on the stored corms, on the surface of which they feed directly. Access to the corms is obtained through cracks in the scales and between the leaves where the stalks have been severed. The thrips appear unable to feed on the living tissue through even the thinnest scale, and were noticeably absent on the true cormels, more than 4,000 of which of several varieties, stored in the same containers with heavily infested corms, were found to be entirely free from thrips or injury. The flesh of the cormel, which is completely encased in a thickened shell and has the point of detachment from the parent corm thickened and hardened by tissues of abscission, is beyond the reach of the insects. A modified type of cormel, lacking the capsule-like covering, but possessing scales, occurs rarely but is readily distinguishable and is not protected from thrips attack. All other living parts of *Gladiolus* are used for food. These include, in storage, the corm surface, young shoots and rootlets ; and during the growing season, the foliage, flower stem, and all parts of the flower spike and flowers, including the developing seed-pod.

SMITH (C. E.). **A hitherto unreported Curculionid Pest of Onion and Garlic in Texas.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1110–1111. Geneva, N.Y., October, 1932.

Larvae of the weevil, *Ceuthorrhynchus tau*, Lec., were observed to be causing damage to seedling onions during February 1932 in Texas. Injury was confined largely to the terminal part of the sheathing bases of the leaves, although larvae were occasionally seen boring downward toward the crown and in the leaves. Infested plants were stunted and deformed, very often splitting and bending. The younger the plant when attacked, the more severe the damage. In one instance it was reported that a 50-acre field had had to be ploughed under on account of the weevil, but later reports from the same district stated that infested crops had recovered sufficiently to produce nearly normal yields. Onions and garlic were generally infested by this weevil over a large area in southern Texas. Heavily infested garlic was seen growing adjacent to seedling onions that were only slightly infested, indicating a preference for the former.

BARRETT (R. E.). **Notes on a new Parasite of the Codling Moth.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1111–1112, 2 refs. Geneva, N.Y., October 1932.

Ephialtes (*Calliephialtes*) *nucicola*, Cush., a recently described Ichneumonid parasite of the codling moth [*Cydia pomonella*, L.], was found to be quite common in walnut orchards in California in 1929.

The material on which Cushman based his description [*R.A.E.*, A, xix, 578] also included single females reared respectively from an acorn of Californian white or valley oak (*Quercus lobata*), from a gall of *Cynips maculipennis*, Gillette, and from the Tineid, *Walshia amorphella*, Clemens. Of 141 parasites reared from walnuts infested with *C. pomonella* between 17th August and 20th September 1929, 109 were males and 32 females. On 23rd August 1929 a female was taken ovipositing in a walnut infested with *C. pomonella*. On 8th September 1930 a male emerged from a pupa of *E. nucicola* found ten days earlier within the green shell of a walnut together with the remains of a codling moth larva. The earliest date that *E. nucicola* was seen in the field was 60 days after the host larvae were first seen. The frass or excreta of *C. pomonella* furnishes the stimulus bringing about oviposition.

The life-history of *E. nucicola* differs greatly from that of *E.* (*C.*) *messor*, Grav. [ii, 137, 553], which was introduced into California from Spain in 1904 but does not seem to be established. Whereas *E. messor* oviposits on the hibernating larvae in the cocoon, *E. nucicola* will only do so if frass is placed on the cocoon and the oviposition response brought about. Even then the parasite often dies in the attempt to pierce the cocoon. It is possible that *E. nucicola* maintains itself through the winter and early spring, when *C. pomonella* is in hibernation, on some other insect, or it may hibernate in the larval, pupal or adult stage within the shell of infested nuts, but its manner of passing the winter has not yet been determined.

Brannon (L. W.). **Observations of the Association of Thrips with Arsenical Injury on Snap Beans.**—*J. Econ. Ent.*, xxv, no. 5, pp. 1112–1113. Geneva, N.Y., October 1932.

A heavy infestation of *Thrips tabaci*, Lind., was observed during the spring of 1932 in Virginia, on beans upon which an experiment was being conducted for the control of *Epilachna corrupta*, Muls., one of the treatments consisting of the application of magnesium arsenate at the rate of 1 lb. to 50 U.S. gals. water. It was found that insecticide injury observed on the plot treated with magnesium arsenate in May and early June did not increase following applications made in combination with nicotine sulphate (1 : 400), which controlled the thrips. In July, when the thrips was no longer present, four applications of magnesium arsenate resulted in no insecticide injury. It is thought that the arsenical gains entrance to the leaf tissue at the time of feeding by the thrips, causing injury in association with their presence, which was not apparent on beans on which they were controlled.

Smith (R. C.). **Upsetting the Balance of Nature, with special Reference to Kansas and the Great Plains.**—*Science*, lxxv, no. 1956, pp. 649–654. New York, 24th June 1932.

The author describes at some length how the balance of nature has been upset in Kansas and the Great Plains during the last hundred years by settlement and agriculture, optimum conditions being thus created for certain indigenous and introduced insect pests. Among the latter is *Mayetiola* (*Phytophaga*) *destructor*, Say, on wheat, barley and rye, which is able to produce many more generations annually than in its original European habitat. Native insects that now attack cereals include *Eleodes* spp. (false wireworms), which are most difficult to

control owing to their having previously become adapted to severe conditions of life, *Chorizagrotis auxiliaris*, Grote, *Blissus leucopterus*, Say, which still overwinters on the native bunch-grass, *Papaipema nitela*, Gn. (*nebris*, Gn.), which can develop in any of 176 species of plants, mostly weeds, *Heliothis obsoleta*, F. (corn earworm), and grasshoppers, of which frequent outbreaks still occur. Native prairie species attacking lucerne, include *Loxostege similalis*, Gn., *Macrosiphum* (*Illinoia*) *pisi*, Kalt., and *Laphygma frugiperda*, S. & A. Miscellaneous examples of changed food habits are afforded by *Leptinotarsa decemlineata*, Say, which has forsaken wild food-plants for cultivated potatoes, *Rhodobaenus tredecimpunctatus*, Ill. (sunflower beetle) which has lately been found to attack beets, and flea-beetles of the genera *Epitrix* and *Systena*, which are increasingly troublesome as garden pests. The principles of biological control are explained, and some outstanding examples of its value are given.

Britton (W. E.). **Connecticut State Entomologist, Thirty-First Report 1931.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 338, pp. 499–603, 12 pls., 7 figs. New Haven, Conn., May 1932. [Recd. October 1932.]

An annotated list (pp. 499–515) is given by W. E. Britton of a number of insect pests occurring in Connecticut during 1931. The Dynastid, *Ochrosidia villosa*, Burm., and the larvae of a weevil, probably *Hyperodes porcellus*, Say, are reported (p. 593) as damaging lawns, the former being recorded for the first time in the State. In discussing the campaign against the gipsy moth [*Porthetria dispar*, L.] (pp. 542–553), J. T. Ashworth and Britton state that in general the insect has not been spread by wind to any appreciable extent, and no serious defoliation has occurred. During the period when the larvae were present, 31 infestations were sprayed, involving the use of nearly 38 tons of lead arsenate. Details of work and State quarantine regulations issued during the year against *Pyrausta nubilalis*, Hb., on maize are given by Britton and M. P. Zappe (pp. 553–558). During 1930 it continued to spread in a westerly direction [*cf. R.A.E.*, A, xix, 532], with the result that 63 new districts were placed under quarantine. Considerable injury was caused in the county in which the infestation is of longest standing, the incidence averaging 80 borers to 100 plants. Britton and J. P. Johnson (pp. 558–565) report that the Japanese beetle [*Popillia japonica*, Newm.] was found in 4 new localities, which were placed under quarantine.

P. Garman in discussing work on the control of the oriental fruit moth [*Cydia molesta*, Busck] (pp. 567–572) states that over 10,000 individuals of *Macrocentrus ancylivora*, Rohw., and 11 million of *Trichogramma minutum*, Riley, were reared and distributed among fruit growers. The former was liberated in orchards at the average rate of one individual to every 14 trees, and the latter at about 70 individuals to a tree. Peach trees having rank twig growth were most severely injured; discretion should, therefore, be exercised in the use of fertilisers, as well as in cultivation and pruning. Experiments with *Trichogramma* have shown that it is not possible to increase the degree of parasitism to more than 50 per cent. by field liberations, but that the parasites disperse far beyond the point of liberation. In the laboratory the application of sulphur dust to the leaves of peach seedlings caused a reduction in parasitism of the eggs on them at higher temperatures,

the percentage parasitised being 100 at 67°F. and 20 at 82°F. Of a number of insecticides tested against leaf-hoppers on apple, of which *Typhlocyba pomaria*, McAtee, was the most important, a spray consisting of 1¼ U.S. gals. lime-sulphur, 1 U.S. pint nicotine sulphate and 100 U.S. gals. water, with 1 lb. iron sulphate added to prevent scorching the foliage, gave the best results against the adults. None of the dormant sprays tested was effective against the eggs. Tests against Aphids showed that variations in temperature and humidity do not affect to any appreciable extent the toxicity of nicotine sulphate when used with an activator, such as penetrol [*cf.* xvii, 715]. There is little doubt that the activator increased the toxicity of the spray, although the toxicity of nicotine sulphate (1 : 2,000) and penetrol (1 : 200) did not equal that of nicotine sulphate (1 : 800) alone.

Britton (pp. 584–585) reports that larvae of *Diaphania nitidalis*, Stoll, were observed, for the first time in the State, injuring summer squash and cucumbers. The winter is passed in a cocoon in a rolled leaf, usually on the ground. The eggs are deposited on the flowers, buds or young terminal leaves, singly or in small clusters, and hatch in 3–4 days. At first the larvae attack the blossoms and later the fruit, although on squash some of them are able to complete their development on the former. They feed for 12–16 days and then spin cocoons, in which they pupate on the following day. During the summer the pupal period lasts 7–10 days. Control measures include the destruction of all débris after harvest and autumn ploughing to destroy the pupae. Early cantaloupes and cucumbers nearly always escape serious injury, and late ones may be protected by planting trap crops of squash (about 4 rows to the acre) every 2 weeks in order to attract the ovipositing moths. The blossoms should be destroyed before the larvae on them complete their development, or the entire plants as the later sown crops begin to bloom.

Britton and B. H. Walden (pp. 585–587) state that five species of thrips, one of which appeared to be *Taeniothrips gladioli*, Moult. & Steinw., caused severe injury to *Gladiolus* throughout the State. The damage they do to the foliage and blooms is discussed. They may also attack the corms in storage, in which they pass the winter, if the temperature in the storehouse is above 50°F. For control, fumigation for 3 hours with calcium cyanide at the rate of about 2 oz. to 1,000 cu. ft. is recommended. Since this treatment does not kill the eggs, it should be repeated after they have hatched and the thrips have reached the pupal stage. If an air-tight fumigating box is available and the temperature can be maintained above 60°F., a mixture of ethylene dichloride and carbon tetrachloride [xvi, 86, etc.] can be used at the rate of 1 U.S. pint per 100 cu. ft., the box being kept closed for 14–24 hours. This treatment appears to kill the eggs. Experiments, discussed by R. B. Friend (pp. 588–592), on the control of *Phorbia* (*Hylemyia*) *brassicae*, Bch., on cabbages, which were conducted on similar lines to those already noticed [*cf.* xvii, 447 ; xx, 528], indicate that two applications of a 4 per cent. dust of mercurous chloride with gypsum as a carrier are effective against this pest on early cabbages. It does not scorch the plants and is not poisonous. This author also reports (p. 596) the discovery of the Coccid, *Phenacoccus serratus*, Ferris, infesting American beech [*Fagus grandifolia*] in one locality during December. Walden (p. 594) reports that *Myzus circumflexus*, Buckt., was found infesting *Gladiolus* corms in storage, having migrated from neighbouring bulbs of Easter lily [*Lilium*

longiflorum]. The infestation was controlled by soaking the corms in nicotine sulphate, 1 : 400, for 30 minutes. *Anuraphis tulipae*, Boy., is reported (pp. 598–599) from one locality severely infesting *Gladiolus* corms stored in premises where the temperature and humidity were high, corms stored on shelves, in the drier parts of the premises, being less severely infested than those on the earth floor.

List (G. M.). **A Cherry Pest in Colorado.**—*Bull. Colorado Agric. Expt. Sta.*, no. 385, 106 pp., 21 figs., 33 refs. Fort Collins, Colo., April 1932. [Recd. October 1932.]

Investigations on the weevil genus *Tachypterellus* show that four forms occur in North America, namely, *T. quadrigibbus*, Say, which is apparently distributed over the east of Canada and the United States and as far south as Florida, *T. quadrigibbus magna*, subsp. n., which is found in Iowa, Kansas, east Nebraska, Illinois, Missouri and Texas, *T. consors*, Dietz., two specimens of which have been taken in Colorado and one in Idaho, and *T. consors cerasi*, subsp. n. (cherry curculio), which is found in the foothill region of Colorado, east of the Rocky Mountains, and in New Mexico. These forms, which are described with a key, are distinct in their several localities, but there appear to be definite regions of intergradation. The native food-plants of *T. quadrigibbus* and *T. quadrigibbus magna* are hawthorn (*Crataegus*) and wild crab apple ; the former is a pest of apples and pears and has been reported from plum, cherry, shadbush [*Amelanchier*] and cotton (this probably not being a food-plant) ; the latter is a pest of apples and has been reported from pear and plum. Little is known of the food-plants of *T. consors*, but it has been taken on apple and probably feeds on hawthorn and choke-cherry (*Prunus melanocarpa*). *T. consors cerasi* has been observed on wild plum and was bred from apple, but could not be reared from hawthorn. Its native food-plant is choke-cherry, but it has become a major pest of cultivated sour cherries in Colorado. A detailed account is given of its bionomics and control in Colorado, and all stages are described.

The following is largely taken from the author's summary : The adults hibernate under rubbish in and around the orchard and on emergence feed on the flowers and immature fruits, the resulting damage being more severe than that caused at any other period. Oviposition begins when the cherries are shedding their calyces and continues for 2–3 weeks, the peak occurring when the fruit is about half-grown. The eggs are deposited in cavities made by the female in the fruit. The larva hatches in 3–11 days and eats its way through the stone to the kernel, which it completely consumes. This feeding, which does not materially affect the growth of the fruit, continues for 18–24 days. The pupal period averages 6·9 days, and the adult remains in the stone for one or more days before emerging. The newly emerged weevils feed voraciously on the ripening cherries for about 7–10 days before entering hibernation. They are rare in the orchards after 1st August. No marked preference is shown for any particular variety, though the time of flowering, hardening of the stones and ripening of the fruit have a bearing on the extent of injury. There appears to be a slight tendency to oviposit in small dwarfed fruits that drop later.

Eight species of parasites were reared during the investigations, and their habits are discussed. *Entedon tachypterelli*, Gahan [*R.A.E.*, A,

xix, 245] was responsible for 50 per cent. of a total parasitism of 78·7 per cent. and was even more numerous in material collected from choke-cherry. Its effectiveness as an endoparasite of the larvae is reduced since it is itself attacked in the larval and pupal stages by the larvae of *Eurytoma tylodermatis*, Ashm. The latter is an ectoparasite of *T. consors cerasi*, feeding chiefly on the larvae, but occasionally on pupae or newly emerged adults, and was responsible for 25–30 per cent. of the total parasitism. It was also reared from *Cydia* (*Grapholitha*) *packardi*, Zell., and *Enarmonia* (*G.*) *prunivora*, Walsh. *Habrocytus piercei*, Crwfd., was of about the same importance as *E. tylodermatis* and feeds externally on the larvae and pupae. It has not been reared from material collected from wild cherry. The other parasites reared were *H. lividus*, Gahan [*loc. cit.*], *Microbracon tachypteri*, Mues., *Zatropis incertus*, Ashm., *Eupelminus saltator*, Lind., and *Tetrastichus* sp.

The conditions under which cherries are grown are discussed, and it is concluded that the heaviest infestations of *T. consors cerasi* occur in orchards having an undergrowth of grass, weeds, etc., which afford suitable hibernation quarters. The destruction of this material and of adjacent trees of choke-cherry is recommended. Experiments with various arsenicals and fluosilicates showed sprays to be more effective than dusts. Sodium fluosilicate proved almost as satisfactory as lead arsenate against the weevil, but was not so effective against the cherry slug [*Caliroa limacina*, Retz.] and *Cydia packardi*, ; 1½ lb. lead arsenate to 50 U.S. gals. water gave somewhat better results than 1 lb. In medium or light infestations, the spray should be applied just after the blossoms fall and again 6–8 days later, just after the calyces drop ; and in heavy ones, or if *C. packardi* is also present, a third application should be made in 7–10 days, when the fruit is about half-grown. Examination of samples from many of the experimental plots revealed arsenical residue in excess of tolerance (0·01 grain arsenic per lb. fruit), as much as 0·04 grain being present in one case. This is reduced to an amount within tolerance during the preparation of the fruit for canning. It appears that three sprays can only be applied to fruit that receives careful washing at the factory ; fruit that is to be sold fresh should not receive more than the first two sprays, and the weaker concentration should be used. About 50 per cent. of the infested cherries can be sorted out by water flotation. They can also be detected at harvest, and if left on the trees at that time, they should later be picked and destroyed.

Wilmot (R. J.) & Walker (F. W.). **The Relation of Hydrocyanic Acid Gas Concentration and Temperature to the Kill of the Larvae in Hibernacula of the Pecan Leaf Case Bearer,** *Mineola juglandis* **(LeB.).**—*Florida Ent.*, xvi, no. 2, pp. 25–28, 3 refs. Gainesville, Fla., September 1932.

Investigations were undertaken in Florida to determine the effect of fumigation with hydrocyanic acid gas on the hibernating larvae of *Acrobasis* (*Mineola*) *juglandis*, LeB. (pecan leaf case-bearer), with a view to preventing their distribution on dormant pecan nursery stock. Apparatus similar to that previously described was employed [*R.A.E.*, A, xix, 315 ; xx, 514], and a vacuum fumigator was also used. The results are given in a table. Total mortality of the larvae in their hibernacula was obtained by exposing them for at least 30 minutes to

a concentration of 0·2 per cent. or more of hydrocyanic acid gas at a temperature of 90°F. Complete control resulted in 30 mins. at 71°F. with an approximate concentration of 0·72 per cent. of hydrocyanic acid gas.

Wilmot (R. J.). **The Effect of Hydrocyanic Acid Gas Fumigation on the subsequent Growth of Pecan Nursery Stock.**—*Florida Ent.*, xvi, no. 2, pp. 28–30. Gainesville, Fla., September 1932.

Examination at yearly intervals until 1931 of the trunk diameter and lineal growth of pecan trees fumigated in 1927 with hydrocyanic acid gas at various dosages and temperatures indicated that, under the conditions of these experiments, nursery stock may be treated without detriment to its subsequent growth.

Tissot (A. N.). **Blister-beetles abundant in Florida.**—*Florida Ent.*, xvi, no. 2, p. 30. Gainesville, Fla., September 1932.

Many insects of common occurrence in Florida were exceptionally abundant during the summer of 1932, largely owing to the mildness of the preceding winter. Blister-beetles were particularly noticeable, severe damage being caused to peppers [*Capsicum*] and egg-plant [*Solanum melongena*] by *Epicauta vittata*, F. (striped blister-beetle) and *E. heterodera*, Horn (gray blister-beetle), the former, which was the more numerous, also attacking sweet potato and growing shoots of *Asparagus plumosus* in ferneries.

Clark (S. W.). **The Control of Fire Ants in the Lower Rio Grande Valley.**—*Bull. Texas Agric. Expt. Sta.*, no. 435, 12 pp., 4 figs., 5 refs. College Station, Tex., November 1931. [Recd. October 1932.]

Solenopsis geminata, F., is the most important pest of young *Citrus* trees in the Lower Rio Grande Valley of Texas. The ants build a nest at the base of the tree and feed on the bark and young tender twigs, often completely girdling the tree and causing its death. Preliminary experiments have shown that calcium cyanide dust applied to the nests with a dust-gun gives good control, but is liable to cause injury to the trees, if it comes in contact with them. If the nest is near the tree, it should be stirred with a rod, and the dust applied as a light covering to the soil, but if it is at a distance, the dust should be stirred in and covered with soil. Tests with a number of baits containing arsenicals gave negligible results, but in experiments in 1930 and 1931 baits containing thallium sulphate proved very efficient, exterminating a high percentage of the colonies. The bait is prepared by dissolving (by boiling if necessary) 2 oz. of thallium sulphate in $4\frac{1}{2}$ U.S. pints of water, and stirring in 5 lb. sugar and 8 oz. honey, until the sugar is dissolved. Enough water should then be added to bring the total to 1 U.S. gal. About 4 tablespoons of bait should be poured over a piece of sponge or non-resinous wood shavings in a box of about $\frac{1}{2}$ pint capacity. The ants enter through a hole in the side of the box, which should be placed on the nest. Thallium sulphate is a slow-acting cumulative poison, so that the ants have ample time to carry it to the nest and feed it to the young. If Coccids or Aphids are present on or near the trees, they must be eradicated before the ants can be satisfactorily controlled. Under other conditions, if, as sometimes happens,

the ants refuse to feed on the bait, calcium cyanide should be used. After the nests have been destroyed, the wounded areas on the trees should be cleaned and painted with Bordeaux paste.

Ball (E. D.). **The Food Plants of the Leafhoppers.**—*Ann Ent. Soc. Amer.*, xxv, no. 3, pp. 497–501. Columbus, Ohio, September 1932.

This is a review of recent work in the United States on the food-plants of leafhoppers, which indicates a very definite and restricted food habit for the great majority of species, the few exceptions forming the nucleus of a small group of injurious species. Moreover, large groups are almost exclusively grass feeders, and other groups that have been reported as such have other food habits. In general all the members of a natural group will be found to be either grass feeders or all of them will have other food-habits. *Acucephalus albifrons*, L., has been recorded as attacking timothy grass [*Phleum pratense*] [*cf. R.A.E.*, A, iv, 454], but the author has observed that injury by this species is confined to plantains growing between the clumps of timothy. As plantain appears to be the most noxious weed in timothy meadows, this leafhopper is undoubtedly a beneficial species.

Drake (C. J.), Tate (H. D.) & Harris (H. M.). **Preliminary Experiments with Aphids as Vectors of Yellow Dwarf.**—*Iowa State Coll. J. Sci.*, vi, no. 3, pp. 347–355, 1 pl., 4 figs., 6 refs. Ames, Iowa, 1932.

Following the discovery of the Aphid vectors of yellow dwarf of onions in Iowa [*R.A.E.*, A, xx, 357], observations have been continued on the transmission, development and behaviour of the disease under greenhouse conditions. Many insects other than Aphids have been tested as vectors, but, except in a very few cases with *Cicadula sexnotata*, Fall. (six-spotted leafhopper) and once with the mealybug, *Phenacoccus* sp., all have been negative. *Aphis rumicis*, L., *Rhopalosiphum prunifoliae*, Fitch, *Myzus persicae*, Sulz., *A. gossypii*, Glov., *Macrosiphum gei*, Koch, and *A. maidis*, Fitch, have been proved to transmit the disease, and all these Aphids are widely disseminated in the United States and Canada. Under field conditions in Iowa, most Aphids spend the winter in the egg stage on the primary food-plant, and the greenhouse studies have been confined to the agamic viviparous forms found on the summer food-plant. Under optimum conditions the Aphids breed rapidly, leading to overcrowding with a consequent tendency to accelerate migration.

By feeding Aphids for 10–20 hours on various parts of diseased onion plants and bulbs, it was proved that the virus occurs in all these parts. Parallel experiments showed that healthy plants may be infected through the feeding of infective Aphids on the roots, bulb, stem or leaves. Under certain field and greenhouse conditions the symptoms of yellow dwarf may be completely masked and not visible until after the bulbs have undergone a rest period and been re-grown ; these masked plants, however, are capable of infecting Aphids, as are also apparently healthy leaves on diseased plants. Infected seedlings, sets, bulbs and commercial onions in which the symptoms are masked may thus serve to carry the disease from season to season and also to infect insects during the first season as well as after the bulbs have been re-grown.

The onion, however, is only a temporary source of nourishment for migrating Aphids; when confined on onion plants, nymphs and alate and apterous adults die in 3–6 days. The first signs of yellow dwarf generally appear in 5–12 days after exposure to infected Aphids, but the plant becomes a source of infection in 3–4 days. Tests showed that one Aphid is capable of inoculating a plant, but the percentage of transmission under such conditions was much less than when more were used. Aphids caged for 30 minutes on diseased plants were infective to healthy plants, inoculating them within another 30 minutes. Infective Aphids transferred from one disease-free plant to another at intervals of four hours for a period of several days were found to lose their infectiveness after a few transfers. After the second transfer, there was either a rapid decline or sudden stop in the number of infections. As no perennial wild plant harbouring the disease has been found in the field in Iowa, the diseased bulb is in all probability the true reservoir of the overwintering virus. Mature or nearly mature plants and slow-growing or unhealthy ones do not seem to be so easily infected as healthy and rapidly growing plants, and more masking seems to occur in the older plants.

The control of the disease is largely a matter of preventing infection of the new crop from the overwintering virus, with subsequent wholesale dissemination by its insect vectors. Spraying to prevent the spread of the disease is expensive and very limited in its possibilities. Complete destruction of all crop remnants and the use of disease-free sets produced in non-infected areas are the most practical remedial measures. As the disease is not seed-borne, and as Aphids do not fly far and soon lose their infectivity, it is possible to produce disease-free sets within a few miles of infected fields. Certain sprays used on onions to control thrips and maggots noticeably lessened the percentage of yellow dwarf infection, especially a combination of 1–1·5 per cent. miscible oil in Bordeaux mixture (4 : 4 : 50) with 0·1 per cent. pyrethrum-soap or nicotine sulphate, applied 3–5 times at weekly intervals. In some plots the infection was reduced from 60 to 2 per cent. by this spray.

Entomological Investigations. *Admin. Rep. Dir. Agric. Br. Guiana 1931*, p. 27. Georgetown, 1932.

Insect pests dealt with in British Guiana during 1931 included *Dyscinetus geminatus*, F., and *D. bidentatus*, Burm., the larvae of which attack sugar-cane and may be controlled by flooding, and the Geocorid, *Athaumastus laetus*, Mayr, on pineapples. Rice was attacked by *Lissorhoptrus simplex*, Say (water weevil), which was successfully controlled by drying the beds, and the stem borers, *Diatraea saccharalis*, F., against which ploughing the stubble and flooding was recommended, and *Scirpophaga albinella*, Cram., which occurs periodically in great numbers, but is parasitised in the egg stage by a Chalcid and in the larval by a Braconid and does not appear to do much damage. *Brassolis sophorae*, L., occurred on coconuts in small numbers throughout the year, the eggs being parasitised by *Telenomus nigrocoxalis*, Ashm., and the larvae by *Spilochalcis morleyi*, Ashm. (*brassolis*, Schrottky) and *Brachymeria* (*Chalcis*) *annulata*, F. *Strategus aloeus*, L., frequently infests young coconut palms.

Work connected with Insect and Fungus Pests and their Control.—*Rep. Agric. Dept. St. Kitts-Nevis 1931*, p. 6. Trinidad, 1932.

In 1931 cotton was severely damaged on St. Kitts by *Alabama argillacea*, Hb. (cotton leaf worm), which was very prevalent throughout the Island. *Platyedra* (*Pectinophora*) *gossypiella*, Saund. (pink bollworm) appeared very early in nearly all fields and caused the loss of a high percentage of the bolls of the first crop, infestation having probably spread from Nevis, where the bolls of the second crop were heavily attacked at the time.

Box (H. E.). **Extract from a Report . . . on a Visit to St. Kitts in February 1932.**—*Rep. Agric. Dept. St. Kitts-Nevis 1931*, pp. 9–12, Trinidad, 1932.

Diatraea saccharalis, F., was found rarely to attack maize in St. Kitts, though it is of extreme importance on sugar-cane, causing a total annual loss of about £10,000–£12,000. Examination of 27 fields of sugar-cane in representative areas revealed average infestations of 79·7 per cent. of the stalks and 11·8 per cent. of the joints, with an average of 3·5 bored joints on each infested stalk. The reduction in sucrose content of the juice owing to joint infestation is estimated at 2·5 per cent. Ratoons were considerably less attacked than plant cane. There is some evidence that the borer is more numerous in wet areas than in drier ones, but there appears to be a greater loss through a given infestation in the latter, where the conditions are less favourable to the recovery of the plants. Three species of injurious fungi gain entry to the plants through the tunnels of *Diatraea* and the weevil, *Metamasius hemipterus*, F.

Though *Trichogramma minutum*, Riley, is very prevalent and frequently prasitises a high percentage of the eggs, it is considered unlikely that it effects any great control. *Telenomus* (*Prophanurus*) *alecto*, Cwfd., which attacks the eggs in Antigua [*R.A.E.*, A, xx, 583], was not observed. In one heavily infested field 5·3 per cent. of the larvae were parasitized by *Microdus stigmaterus*, Cress. The fungus, *Cordyceps barberi*, was observed infesting the larvae, but its abundance was not estimated. There is no evidence that the numbers of *D. saccharalis* are reduced by trapping at lights or by removing the infested hearts from plants in the field, and the introduction of *Lixophaga diatraeae*, Towns., for its control is recommended [*cf.* xix, 627].

Chamberlin (W. J.). **An Introduction to Forest Entomology : A Manual.**—138 pp. mimeogr., 9 pls. Ann Arbor, Mich., Edwards Bros. Inc. [1931.] [Recd. November 1932.]

This is a general introductory course in forest entomology for students who have had no training in entomology or allied sciences, and gives some of the required fundamental information with ample reference to further works on the subjects dealt with. The manual covers many aspects of forest entomology, includes descriptions of the chief orders of insects and outlines the principles of natural and artificial control of pests. A special chapter deals with the control of bark-beetles. In some of the chapters, questions are included that indicate the more important points and serve as a basis for examination, and a general index, as well as one to the insects concerned, is appended.

Eyer (J. R.). **Laboratory and Field Manual of Economic Entomology.** —121 pp. mimeogr., 11 figs. Ann Arbor, Mich., Edwards Bros. Inc. [1932.]

This manual is divided into four parts dealing with insect anatomy, taxomony and metamorphosis; control measures, including insecticides, mechanical and cultural methods, quarantines and biological control; methods of studying the literature and preparing an entomological thesis; and field and laboratory studies of the commoner insects injurious to crops in North America. It is a comprehensive guide for students approaching a study of the subject, and exercises dealing with each aspect are outlined. A field key to the commoner insect pests, based partly on the type of damage caused, is also given.

Horn (W.). **Einige Bedenken gegen neuere Anschauungen über Massenvermehrung von Insekten.** [Some Doubts regarding modern Views on Mass Increases of Insects.]—*4. Wanderversamml. deuts. Ent. Kiel* (*11–15. vi. 1930*), pp. 43–50. Berlin, December 1930.

The conclusion reached in this paper is that statistics of the eggs laid by an insect pest and of their viability are more reliable guides to the prediction of outbreaks of insects than mathematical formulae based on temperature and moisture.

Communications diverses sur le traitement hivernal des arbres fruitiers. —*Rev. Path. vég. Ent. agric.*, xix, no. 3, pp. 70–118, 1 pl., refs. Paris, March 1932. [Recd. October 1932.]

This series of papers summarising modern methods of winter treatment of fruit trees against pests comprises the following: On the Winter Spraying of Fruit Trees in England, by G. T. Gimingham; Some Observations on Winter Treatments of Fruit Trees, by L. Petri (in Italian); The Spraying of Fruit Trees in Holland, by N. van Poeteren (in French); Insects and Fungi infesting Fruit Trees, by H. Faes (in French); Some Observations on the Treatments required for Apricots and Peach Trees in the Rhône Valley, by P. H. Joessel (in French); and On some current Problems concerning the Winter Treatment of Fruit Trees, by F. Willaume (in French).

Imms (A. D.). **Observations on some Parasites of *Oscinella frit* Linn. Part II.**—*Parasitology*, xxiv, no. 3, pp. 440–447, 2 figs., 9 refs. Cambridge, October 1932.

A continuation and extension in 1929 and 1930 of observations carried out in the Harpenden district, England, on the parasites of *Oscinella frit*, L. [*R.A.E.*, A, xviii, 518] confirm the previous years' conclusions and also indicate that there is considerable fluctuation in the relative status or frequency of occurrence among the several species present.

The following general conclusions are drawn from the results of the whole series of observations (1926–1930): The extent of destruction of the stem generation of *Oscinella frit* through the agency of parasites increases progressively with the normal advance of the season. When the host insect infested oats that were sown between 28th February and 15th March, the mean percentage destroyed by parasites was 23.

When the sowing dates were between 20th March and 25th April, it was 43·5. The increase in intensity of parasitism appears to be correlated with an annual seasonal increase in the parasite population.

The primary parasites involved were the Cynipid, *Eucoila* (*Rhoptromeris*) *eucera*, Htg., the Diapriid, *Loxotropa tritoma*, Thoms., and the Miscogasterid, *Halticoptera fuscicornis*, Wlk. The Pteromalid, *Callitula bicolor*, Spin. (*Micromelus rufomaculatus*, Wlk.), the synonymy of which is discussed, occurred in smaller numbers and its status was undetermined. It is recorded for the first time as a parasite of *O. frit*, and both sexes of the adult are described in detail. The possibility of its being a secondary parasite [*cf. R.A.E.*, A, ii, 65] requires investigation.

Anderson (M. L.). **Experiment in Control Measures against Damage in Nurseries by the Brown Chafer** (*Serica brunnea*).—*Scot. For. J.*, xlv, pt. 2, pp. 149–154. Edinburgh, October 1931. [Recd. October 1932.]

An account is given of experiments with a number of soil fumigants against the larvae of *Serica brunnea*, L., a pest of coniferous nursery stock in Scotland, in seed beds of one-year-old larches. Trichlorethylene (C_2HCl_3) gave the best results, complete mortality being obtained. It was applied during May, at the rate of twelve 5-gm. dosages to the square yard, with a proprietary soil-injector that enables fixed amounts of liquid to be injected to a depth of 8–9 ins. without disturbing the plants. The soil treated was a free dark sandy loam, almost a sand, with a few stones. The treatment should be applied at the commencement of an attack, before the infestation has become general, and should be repeated once or twice during the summer, since the larvae may not have all come up from the deep layers of the soil at the time of the first injection and it is impossible to cover the whole area thoroughly with a limited number of injections to the square yard.

MacDougall (R. S.). **Insect Pests. No. xvi.**—*Scot. J. Agric.*, xv, no. 4, pp. 429–437, 3 figs. Edinburgh, October 1932.

This part of a series of papers on insect pests in Britain [*cf. R.A.E.*, A, xx, 541, etc.] is the first dealing with the Rhynchota. A brief general account is given of the characteristics of the Order and of the Suborder Homoptera, with notes on the habits of the Cercopids and Aphids and an outline of the life-cycle of the cabbage aphis [*Brevicoryne brassicae*, L.], as typical of that of an Aphid that is confined to one kind of plant.

Hille Ris Lambers (D.). **Gegevens over biologie en bestrijding der bietenvlieg. II.** [Data on the Biology and Control of the Beet Fly. II.]—*Meded. Inst. Suikerbietenteelt*, ii, no. 4, pp. 163–214, 4 pls., 4 figs., 4 graphs, 19 refs. Bergen op Zoom, June 1932. (With a Summary in English.)

The literature on *Pegomyia hyoscyami*, Panz., was reviewed in the preceding part of this paper [*R.A.E.*, A, xx, 120]. This part gives in great detail the results of the author's investigations in 1931 in the district of North Groningen, Holland. The morphology of all stages is

described. Isolated beet plants in the rows were preferred for oviposition. The larva hatched in 4–6 days, usually boring through the egg-shell into the tissue of the leaf on which the egg was laid. The various forms of leaf-mines are described. In dry ground pupation occurred at an average depth of just over 2 ins. and in wet ground at 0·6 in. Heavy rains result in pupation near the surface. The duration of the pupal stage varies, and there are probably stragglers in each generation; the development of first generation pupae lasted from 14 days to 3 months. Captive adults mated 1–6 days after emergence, and in the laboratory pairing sometimes occurred at night, so that dark, cloudy weather is not likely to suspend it. The adults tend to fly against the wind, a fact of importance as regards spread.

Natural enemies observed included the Anthomyiid, *Coenosia tigrina*, F., which was predacious on the adults, the mite, *Tyroglyphus* (*Tyrophagus*) *putrescentiae*, Schr., which attacked the pupae, and *Smynthurus viridis*, L., which was found feeding on the eggs, up to 50 per cent. being destroyed in one instance. In some heavy infestations rooks and starlings assembled to feed on the larvae. No egg-parasites were obtained, but the Braconids, *Opius spinaciae*, Thoms., and *O. fulvicollis*, Thoms., infested the larvae, and the Ichneumonid, *Phygadeuon pegomyiae*, Hbm., was observed parasitising the pupae in the ground, and probably develops inside the pupal case. A Staphylinid, ? *Aleochara bilineata*, Gyll., and a Cynipid, *Eucoila* sp., were bred from the puparia, and the adult flies were infested by the fungus, *Empusa muscae*.

Adults of the overwintered generation of *P. hyoscyami* first occurred on 11th May, and those of the first generation on 29th June. During a very wet period from 6th to 21st July, *E. muscae* killed most of the flies, and the eggs deposited were of an abnormal type that failed to hatch, so that the second generation did little damage and the third was unimportant. It was not possible to find a connection between the fungus and the production of the abnormal eggs, which are possibly the same as the infertile ones observed in Germany [*R.A.E.*, A, xvii, 599]. The Groningen infestation by *P. hyoscyami* was most severe in fields near the sea. Calcium cyanide, mixed at the rate of 1 per mille with soil, killed all the pupae placed in the soil, but is unsuitable for practical work. Early and dense sowing is advised, the plants being thinned out after the peak of oviposition and while most of the larvae are still in the leaves.

JENSEN (A. S.). **Studier over** *Incurvaria koerneriella* **Zell. (Lepidoptera, Incurvariidae).** —*K. danske Vidensk. Selsk. Biol. Meddel.*, x, no. 5, 49 pp., 32 figs., 10 refs. Copenhagen, 1932. (With a Summary in German.)

In Denmark *Incurvaria koerneriella*, Zell., the larva and pupa of which are described, lays its eggs during the latter half of May in the lower surface of the young leaves of beech. The larvae mine in the leaves until mid-June, when they make cases of pieces of leaf. They then feed on the leaves on the tree until the end of the month, after which they migrate to the ground, where they complete their feeding on fallen leaves, constructing larger cases at intervals. They hibernate and then pupate in their cases. A few of the larvae are destroyed by birds or attacked by the Ichneumonid, *Ecphoropsis vexans*, Holmgr.

Helm (A.). **Ein Grünrüssler als Grossschädling.** [A Weevil as a serious Pest.]—*Anz. Schädlingsk.*, viii, no. 10, pp. 127–128. Berlin, October 1932.

Adults of a weevil of the genus *Polydrosus*, probably *P. sericeus*, Schall., are recorded as causing serious damage in orchards in Germany. Feeding occurred on the blossoms, leaves and young fruits of apples and pears, up to 50 per cent. of the apple blossoms being destroyed in some plots. Cherry trees were almost entirely defoliated, and plum, maple, oak and birch were also infested. Successful control was obtained with a proprietary arsenical spray.

Barbey (A.). **Les insectes forestiers du Parc National suisse.**—*Ergeb. wiss. Untersuch. schweiz. Nationalparks*, no. 6, 48 pp., 24 pls., 1 map. Aarau, H. R. Sauerleander & Co., 1932. Price *Fr.* 12.

As it was thought that the maintenance in the precincts of the Swiss National Park of large tracts of forest preserved from future exploitation would be conducive to heavy insect invasions, the area was systematically inspected for a few days each year from 1918 to 1928. A preliminary report was drawn up in 1918 and is given as an appendix to the present paper. The Park was found to harbour the typical insect fauna of the Alps, and there is no indication that the abandonment of forest practices will result in the attraction of fresh species. On the other hand, as the older trees die, the number of injurious insects, particularly secondary pests, will increase. In the plains the xylophagous species are generally specific to a single species of conifer, but in the Park several species of bark-beetle may be found together on different ones. Accidents, such as avalanches, storms or fires, may lead to such multiplication of secondary pests that healthy trees may eventually be attacked, but the severity of the climate and the shortness of the summer season are the best protection against excessive infestation. Ichneumonid and Braconid parasites have occasionally been observed attacking the larvae of Longicorns and Bostrychids, but nothing definite can yet be decided regarding their value. Descriptions and biological notes are given on 61 species of insects observed during these surveys.

Nägeli (W.). *Periclista lineolata* **Kl., eine Eichenblattwespe als Forstschädling.** [*P. lineolata*, an Oak Sawfly as a Forest Pest.] — *Mitt. schweiz. CentAnst. forstl. Versuchswes.*, xvii, no. 1, pp. 75–91, 6 figs. Zürich, 1931. [Recd. October 1932.]

The infestation of oaks by *Periclista lineolata*, Klug, in Switzerland is apparently spreading, pedunculate oaks being more severely attacked than sessile oaks. The larvae skeletonise the leaves, and young oaks, up to about 12 ft. in height, may be completely defoliated. There is a marked preference for the leading shoot, and defoliation usually starts at the top of the tree. Descriptions of the larvae of this sawfly and of the allied species, *P. melanocephala*, F. (*albida*, Klug) and *P. pubescens*, Zaddach, are reproduced from the literature, with further detailed notes on that of *P. lineolata*. In 1931 the adults were observed on the wing on 15th May, and oviposition occurred at that time. From leaves taken into the laboratory, larvae hatched on 21st and 22nd May. The active larval stage lasts on an average from mid-May to mid-June, but is influenced by the weather. When full-fed,

the larvae make cocoons just below the surface of the ground, in which they hibernate, pupating in the following spring. It is believed that some of the larvae undergo a diapause. Ants and a predacious sawfly, *Rhogogaster viridis*, L., prey on the larvae, and they are attacked by a Hymenopterous parasite, possibly the Ichneumonid, *Plectiscus tenthredinarum*, Giraud, which has been recorded from *Mesoneura opaca*, F. (*Dineura verna*, Klug), some individuals of which were found in the same locality. As many as four larvae of this parasite have been observed on one host larva. The cocoons of *P. lineolata* yielded one adult of *Mesoleius holmgreni*, Schmied. (*formosus*, Hlmgr.) and another parasite that is thought to be the hitherto unknown male of *Caenocryptus striolatus*, Ths.

Nedeltcheff (N.). **Un nouvel ennemi de la vigne en Bulgarie—la chenille mineuse des feuilles de vigne**—*Antispila rivillei* **Stt.**—*Ann. Fac. Agron. Sylvic.*, Sofia, 8, pp. 365–368, 2 figs. 1930. [*In Bulgarian* with a Summary in French.] (Abstract in *Neuheiten Geb. PflSchutzes*, 1932, no. 3–4, p. 67. Vienna, October 1932.)

The Tineid, *Antispila rivillei*, Staint., which is a Mediterranean species, is recorded for the first time from Bulgaria, mining in vine leaves.

Schimitschek (E.). **Beobachtungen bei dem Auftreten und der Bekämpfung der Kieferneule** *Panolis flammea* **Schiff., in Niederösterreich.** [Observations during the Occurrence and Control of the Pine Noctuid, *P. flammea*, in Lower Austria.]—*Zbl. ges. Forstwes.*, lvii, pp. 321–342, 391–406. [Vienna, 1931.] (Abstract in *Neuheiten Geb. PflSchutzes*, 1932, p. 73. Vienna, October 1932.)

The pine Noctuid, *Panolis flammea*, Schiff., was abundant in some parts of lower Austria in 1930, about 300 pupae per square yard being found in December. Of these 16 per cent. were parasitised. In 1931 a proprietary dust containing 15 per cent. calcium arsenate was applied at the rate of about 44 lb. per acre with successful results, and without injuring the ground fauna, which included *Formica rufa*, L., an ant that preys on the larvae. Of the pupae collected in autumn 84 per cent. were parasitised by Tachinids and 4 per cent. by Ichneumonids. The chief parasite was the Tachinid, *Ernestia rudis*, Fall., followed by the Ichneumonid, *Banchus femoralis*, Thoms. Others included the Tachinids, *Phryxe erythrostoma*, Htg., and *Blepharomyia pagana*, Mg., which are recorded for the first time from *P. flammea*. The fungus, *Isaria farinosa*, infested 10 per cent. of the pupae and 3·6 per cent. of the Tachinids.

Ripper (W.). **Ein neuer Kiefernschädling.** [A new Pest of Pine.]—*Zbl. ges. Forstwes.*, lviii, pp. 68–69. Vienna, 1932. (Abstract in *Neuheiten Geb. PflSchutzes*, 1932, p. 74. Vienna, October 1932.)

In Lower Austria the buds of young and old pines were mined in spring by the larvae of *Rhyacionia* (*Evetria*) *pinicolana*, Zell. This was especially noticeable at the edges of the forest on the sunny side of the trees. The adult occurs in June and July.

CANDURA (G. S.). **Contributo alla conoscenza morfologica e biologica dello struggigrano (*Tenebroides mauritanicus* L.).** [A Contribution to the Knowledge of the Morphology and Biology of *T. mauritanicus*.]—*Boll. Lab. Zool. Portici.*, xxvii, pp. 1–56, 18 figs., 8 pp. refs. Portici, 8th September 1932.

An account is given of seven years' investigations in Italy on the biology of *Tenebroides mauritanicus*, L., in stores of wheat and other products. All stages are described in detail. The adults occurred throughout the year, being most abundant in August. They avoided light and were predominantly carnivorous, searching for grain-infesting insects in all stages and devouring their own larvae, though they were also able to adapt themselves to feeding on grain. They usually fed on larvae of *Plodia interpunctella*, Hb., at the surface of heaps of grain, but often sought those of *Silvanus surinamensis*, L., at the bottom. Adults emerging in spring and summer often lived 6–7 months, and those emerging at the end of summer or in autumn for a year. Mating occurred 1–2 weeks, and oviposition from a fortnight to several months, after emergence. From 500 to 1,000 eggs per female were observed on the grain, but larger numbers are probably laid, as females were seen eating their eggs. Oviposition began in spring and continued until autumn, the eggs hatching in 5–15 days.

The chief food of the larvae was wheat grain, but in a restricted space they devoured each other as well as dead adults of their own and other species. Newly hatched larvae preferred broken or gnawed grains. Machines that both reap and thresh produce many broken grains, and severe loss results if such grain is infested and not quite dry. In the final instar, the larvae fed almost exclusively on the embryos and adjoining starchy part, so that though a larva required on an average only 338 mgm. of wheat, 100 larvae were found to destroy the germinating power of about 10,000 grains. In experiments oats were never attacked and only one grain of barley, but larvae that had consumed the supply of wheat completed their development on rice, and maize and rye were more or less severely attacked. In a heap the warm and moist deep layers were preferred. In spite of its predacious habits *T. mauritanicus* must be regarded as a very serious pest in grain warehouses. Larvae and pupae of *Sitotroga cerealella*, Ol., inside the grains, were usually secure against attack, and even in restricted spaces the beetles did not always destroy all the other grain pests present, this being observed with *Troctes*, *Calandra*, *Sitotroga cerealella*, *Plodia interpunctella*, *Ephestia kühniella*, Zell., and *Silvanus surinamensis*. Adults and larvae in all stages were active during the winter, actual hibernation occurring only when low temperatures obtained. The eggs and pupae, however, succumb to cold and were not observed in winter. Both adults and larvae can live in the open, especially in the mines of xylophagous insects, on which they feed.

In tobacco factories all stages of *T. mauritanicus* occurred in the bales of dry tobacco, boring in all directions in search of insect larvae. Young larvae fed on tobacco, but died unless able to feed also on insects. Larvae in infested bales took 2–3 years to develop and ultimately destroyed the tobacco by boring. *Lasioderma serricorne*, F., and *Ephestia elutella*, Hb., were seen in dry tobacco, in which the latter had 2 generations a year, hibernating in the larval stage. *L. serricorne* had 3 generations. The presence of *T. mauritanicus* in tobacco indicates that of other pests, which it cannot eliminate without

destroying the tobacco. It also occurred in association with the breeding of silkworms [*Bombyx mori*, L.], the larvae feeding on those of *Dermestes*.

Among the natural factors affecting *T. mauritanicus* was unsuitable food, the larvae failing to survive on grain that was too dry and too hard, or in flour not of the whole-meal type. Natural enemies included *Pediculoides ventricosus*, Newp., and a Bethylid, *Cephalonomia nigricornis*, Sarra [*R.A.E.*, A, xix, 249]. The best measures are preventive and consist in keeping warehouses clean and in maintaining a condition of dry cold in them. Remedial measures are fumigation with hydrocyanic acid gas or carbon bisulphide or the application of dry heat.

VITALE (F.). **Il *Pissodes notatus* Fabr. in Sicilia.** [*P. notatus* in Sicily.]—*Giorn. Agric. merid.*, 1929, reprint 8 pp. Messina, 1929. [Recd. October 1932.]

In 1928 *Pissodes notatus*, F., began attacking pines from 4 to 20 years old in the reafforestation plantations in Sicily. Not only these but also old pines were subsequently destroyed. The weevils oviposit in the bark of the stem, and the larvae feed in the cambium. The author's observations showed that there are at least 2 generations a year in Sicily. Eggs were observed in June, larvae in August, pupae in September, and adults in October. These hibernate and appear in April, producing the first generation of the year. The measures suggested were bird protection, destruction of unhealthy trees, which attract the weevil, removal and burning of infested stumps in June and October, removal of bark from infested stems and branches, and the use of trap-logs. Mixed forests are advised for future planting.

Sirex gigas, L., is recorded as attacking Aleppo pine [*Pinus halepensis*] in one locality, and *Thaumetopoea* (*Cnethocampa*) *pityocampa*, Schiff., as infesting *Pinus laricio* in another.

MORRIS (H. M.). **Insect Pests and Fungus Diseases of Cyprus and their Control.**—*Bull. Dept. Agric. Cyprus*, (Ent. Ser.) no. 3, 56 pp., 12 figs. Nicosia, September 1932. Price 6*d*.

Of the first 42 pages of this handbook, 22 are devoted to insect control and formulae and instructions for the preparation of insecticides, and the remainder to notes on the bionomics of the more important insect pests, which include, in addition to a number mentioned in various reports [*R.A.E.*, A, xv, 655; xix, 442; xx, 101, etc.], *Mayetiola destructor*, Say, which chiefly infests wheat but also occurs on barley, and the vine moth, *Polychrosis botrana*, Schiff.

VUKASOVIĆ (P.). **Novi Prilog Proučavanju entomofagnih Insekata Parazita.** [New Contribution to the Study of entomophagous parasitic Insects.] [*In Serbian.*]—*Rad Jug. Akad. Znan. Umj.*, ccxliv, pp. 20–47, 14 figs., 19 refs. Zagreb, 1932.

In continuation of previous work [*R.A.E.*, A, xvii, 210], notes are given on 13 insect parasites observed in Jugoslavia in the course of the last few years. The female genitalia of *Nemeritis canescens*, Grav., *Lariophagus distinguendus*, Först., *Pimpla pomorum*, Ratz., and *Ecphylus* sp. (possibly *eccoptogastri*, Ratz.) and the digestive organs of

the first two species are described. Some of the information given on *N. canescens*, which was reared from flour infested with *Ephestia kühniella*, Zell., and *Plodia interpunctella*, Hb., is similar to that already noticed [xvi, 171 ; xix, 324]. Males of this Ichneumonid have never been found. The adult females lived 2–12 days, with an average of 4·5 [*cf.* xviii, 506 ; xix. 36] ; excessive humidity shortened their life. The reproductive capacity was comparatively great ; in one instance a female placed with the larvae of *E. kühniella* gave rise to 79 adults. At 22–25°C. [71·6–77°F.] the egg and larval stages lasted 10–11 days, the spinning of the cocoon occupied about 24 hours, and the prepupal and pupal stages were completed in 12 days Another parasite reared from the same pests was *Microbracon hebetor*, Say.

Pimpla pomorum was bred from pear buds containing larvae of *Anthonomus cinctus*, Redt., and from apple and pear flower buds infested with *A. pomorum*, L., the rate of parasitism being, however, only 2–3 per cent. This Ichneumonid deposited 2–3 eggs on the larva of the weevil [*cf.* xvii, 408], which it first paralysed, but only one of the ectophagous larvae matured [xix, 324]. Under favourable conditions the development of the larvae, which are very active, is completed in 4 days, and the prepupal and pupal stages, which are passed in a cocoon, last about 2 and 9·5 days respectively. In the laboratory the adult females lived for a maximum of 21 days, whereas the males did not live for more than 3.

The Braconid, *Opius ruficeps*, Wesm., was obtained from about 18 per cent. of the pupae of *Pegomyia nigricornis*, Strobl, which infests the foliage of *Cirsium* and *Carduus*. The host larva pupates before being killed by the parasite. The adults of the latter only lived for 2–3 days. Another Braconid, *Ecphylus* sp. (? *eccoptogastri*), which has not previously been recorded from Jugoslavia, was obtained from branches infested with *Scolytus* (*Eccoptogaster*) *rugulosus*, Ratz., and *S.* (*E.*) *mali*, Bechst., the adult parasites emerging in June-August. In all instances the host larva was attacked by a single larva of the Braconid, which is ectophagous. The pupal stage of the males lasted 6 days ; the adult males lived for 3–8 days and the females for 10–11. Two larvae of *Apanteles* sp. (? *xanthostigma*, Hal.) were found in pear flower buds infested with *A. pomorum* ; the adults emerged in the beginning of April. This is probably the first record of parasitism of a Coleopterous larva by a Braconid of this genus.

Lariophagus distinguendus was obtained from macaroni and wheat infested with *Calandra granaria*, L., and *C. oryzae*, L., and had two generations a year. When reared in a vessel with *C. granaria* over a period of two years, the parasite was not able to exercise complete control, as the weevil developed more rapidly. Another Pteromalid, *Habrocytus* sp. (? *saxeseni*, Ratz.) was very rare, only a single female being obtained from pear buds infested with *A. cinctus*. The behaviour of the females during oviposition and the methods of parasitism are described [xix, 324]. The ectophagous larvae developed in 17 days on those of *Orthopelma luteolator*, Grav., and the Cynipid, *Rhodites rosae*, L. [*cf. loc. cit.*], whereas those on *Macrosiphum* (*Siphonophora*) *rosae*, L., and *Tinea pellionella*, L., were unable to develop, as the host larvae dried up.

The information given on the Aphelinid, *Coccophagus scutellaris*, Dalm., which was reared from the larvae of *Lecanium corni*, Bch., and *L. coryli*, L., has already been noticed [xix, 323]. The ratio of parasitism was generally very low. The Encyrtids, *Cerapterocerus mirabilis*,

Westw., and *Blastothrix sericea*, Dalm., which also parasitised *L. corni*, were very rare, only a few being obtained from mature scales in June. A single adult of the Torymid, *Monodontomerus aereus*, Wlk., was reared from a nest of *Hyponomeuta malinellus*, Zell.

Tachina (*Eutachina*) *civilis*, Rond., was bred chiefly from the larvae of *Loxostege* (*Phlyctaenodes*) *sticticalis*, L., the eggs occurring on them in the first half of June, and the larvae and pupae being observed a little later in the month. Pupation took place in the soil, and the pupal stage lasted 12 days. The rate of parasitism did not exceed 20·3 per cent.

KADOCSA (G.). **Vorfrucht und Bodenbearbeitung im Kampfe gegen die Drahtwürmer.** [Green-crop and Soil Treatment in combating Wireworms.]—*Arch. Zool.*, xvi, no. 3–4, pp. 1028–1045, 11 refs. Torino, 1932.

This paper discusses the relation of infestation by wireworms to agricultural practices in Hungary and gives an important table of the results of observations on the effect of various catch-crops and soil treatments on infestation of an after-crop of maize (and in one instance of sugar-beet) during 1928–30. After winter wheat, maize showed more or less infestation, the treatment of the soil being immaterial so far as wireworms were concerned. After other cereals, maize was in most cases free from attack, and maize followed by maize was rarely infested. An already infested field remained infested, but the state of growth of the plants at the time of egg-laying was not favourable to further infestation.

MAYNÉ (R.). **Observation sur une pyrale nouvelle nuisible à l'***Elaeis guineënsis*, *Pimelephila ghesquierei* **Tams.**—*Arch. zool.*, xvi, no. 3–4, pp. 1097–1101, 2 refs. Torino, 1932.

Serious damage to oil-palms (*Elaeis guineënsis*) by the Pyralid, *Pimelephila ghesquierei*, Tams, was first recorded in the Belgian Congo in 1927 [*cf. R.A.E.*, A, xix, 684]. Young, planted palms, 2–3 years old, were almost exclusively attacked, wild palms and those over 5 years old not being damaged. The eggs are laid on the young unfolded leaves, in which the larvae make superficial galleries, older leaves being attacked later. The pupae are found in cocoons attached to the central vein. After 2 or 3 years, the palms have a very dwarfed appearance, growth ceases and many die. The best control is daily collection of the larvae and the planting of palms only when conditions are favourable for vigorous growth, with appropriate manuring when necessary.

STOREY (H. H.). **The Inheritance by an Insect Vector of the Ability to transmit a Plant Virus.**—*Proc. Roy. Soc.*, (B) cxii, no. 774, pp. 46–60, 13 refs. London, 1st November 1932.

During investigations on streak disease of maize in South Africa and its insect vector, *Cicadulina mbila*, Naudé, it was found that exceptional individuals of this leafhopper were unable to transmit the virus [*R.A.E.*, A, xvi, 336]. A detailed account is given of breeding and transmission experiments to discover the reason for this, which showed

that the ability to transmit is a hereditary character, races having been bred of which some are able and others unable to transmit the virus in the natural process of feeding on maize plants. The crossing of the pure races has demonstrated that the ability to transmit is inherited as a simple dominant Mendelian sex-linked factor.

WATERLAND (H.). **The Clove Chafer.**—*Ann. Rep. Agric. Dept. Zanzibar, 1931*, p. 3. Zanzibar, 1932.

The larvae of an undescribed species of the Melolonthid genus *Idaecamenta* are recorded as attacking the roots of clove trees [*Eugenia caryophyllata*], which showed signs of die-back. The importance of this pest has not been determined ; it is widespread throughout the clove areas of both Pemba and Zanzibar, particularly in the latter Island.

DU PASQUIER (R.). **Principales maladies parasitaires du théier et du caféier en Extrême-Orient.**—*Bull. écon. Indochine*, xxxv, pp. 223 B–253 B, 5 pls., 17 figs., 54 refs. Hanoi, 1932.

This is the first of a series of papers dealing with the insects and fungi attacking tea or coffee in Indo-China, as well as the more important ones occurring in other countries in the Far East (including India, Ceylon and the Netherlands Indies) and is devoted to the Coleoptera, the information given being largely based on the literature. The chief pests, the bionomics and control of which are discussed in some detail, with notes on their natural enemies, comprise the Cerambycid, *Xylotrechus quadripes*, Chevr., which is particularly injurious to coffee in southern India, Indo-China and the Philippines ; Scolytids of the genus *Xyleborus*, of which *X. morigerus*, Bldf., *X. morstatti*, Hag., and *X. discolor*, Bldf., are pests of coffee in Indo-China ; and *Stephanoderes hampei*, Ferr. (coffee berry borer), which in Asia has only been definitely recorded from the Netherlands Indies. Brief notes are given on a number of species of minor importance, of which those occurring in Indo-China include the Melolonthid, *Apogonia rauca*, F., the adults of which sometimes cause severe damage to tea and also attack coffee, the Curculionids, *Hypomeces squamosus*, F., which sometimes infests tea and coffee, and *Corigetus mandarinus*, Fairm., which is occasionally found on tea, and an unidentified Cerambycid larva, which may cause serious damage to tea and coffee.

MISHIMA (R.). **An Account of *Phthonosema theae* Mats.** [*In Japanese.*] —*Agric. Hort.*, vii, no. 9, pp. 1709–1718, 3 figs. Tokyo, August 1932.

A description is given of the Geometrid, *Boarmia* (*Phthonosema*) *theae*, Mats., which is very injurious to tea in the Nara Prefecture of Japan. It has one generation a year, the adults emerging in November and living 18–20 days. The eggs, in which stage hibernation takes place, are laid in groups in crevices on the bark of persimmon (*Diospyros kaki*) growing in the tea-fields and hatch in April, when the buds of the

tea are just opening. The larvae are very active and begin to feed 2 or 3 days after hatching. They mature in about 7 weeks, the full-grown larvae feeding only at night. The pupal stage lasts about 24 weeks.

KANBE (T.). **On the Life-history of *Propylaea japonica* Thunb., as an Enemy of Aphids.** [*In Japanese.*]—*Rep. Korea Agric. Expt. Sta.*, vi, no. 1–2, pp. 25–34. Suigen, Korea, March 1932.

The Coccinellid, *Propylaea japonica*, Thnb., which is predacious on the cotton aphis [*Aphis gossypii*, Glov.], is active from the end of April to November in the southern part of Korea. There are four generations a year, the overwintering adults living about 200 days, and those of the other generations about 50. Over 3,000 Aphids may be eaten during the adult life of the beetle, with an average of 1,456 and a daily average of 78·5. About 310 eggs are laid by a female, which hatch in 4–8 days. The larva matures in 5–29 days, the period varying according to the temperature, and destroys an average of 187 Aphids. The pupal stage lasts 3–12 days. Larvae placed experimentally among the Aphid colonies were killed by ants attendant on the Aphids, and measures against them would be required if the Coccinellid were used for biological control.

CLARK (A. F.). **The Pine-bark Beetle, *Hylastes ater*, in New Zealand.**—*N.Z.J. Sci. Tech.*, xiv, no. 1, pp. 1–20, 15 figs., 2 charts, 11 refs. Wellington, N.Z., August 1932.

These studies on *Hylastes ater*, Payk. (pine bark-beetle) were conducted in North Island, New Zealand, where an outbreak occurred in 1929 in a plantation of about 70 acres consisting chiefly of *Pinus radiata* and *P. pinaster*, the greater part of which had been logged and replanted. All stages of this Scolytid are described, with notes on its systematic position, economic importance and geographical distribution.

The adults are on the wing in late July. They mine and oviposit in the roots and under the bark of fresh stumps, at the base of dead or dying trees and in logs (preferably in the part in contact with the ground). The larvae feed on the inner bark and cambium, and it is essential that these tissues should be in a fresh condition. There are 3 generations annually, which overlap to some extent, adults and larvae occurring throughout the year. The females are capable of laying considerable numbers of eggs, over 100 being frequently observed in the mother gallery. The egg stage occupies 2–3 weeks, and the pupal 8–12 days. The larvae feed for 6–7 weeks, after which they enter a resting stage prior to pupation, which varies in duration according to the time of the year, lasting 1–2 weeks during the summer. In the field, breeding has been found to occur in *P. radiata*, *P. muricata*, *P. pinaster* and *P. ponderosa*.

The adult beetles may cause severe injury to young pines by feeding on the bark and cambium at the base of the stem. Counts made in two plots of young trees in the infested area during a period of 14 months showed 27 per cent. killed by *H. ater*. The damage was most pronounced the first year after planting, and was appreciably less after that period, probably because the established trees were able to outgrow

the injury. In feeding tests, *P. ponderosa*, *P. laricio*, *Sequoia sempervirens*, and *Chamaecyparis lawsoniana*, were attacked, but not *Cupresssus macrocarpa*; in each case no other food-plant was available.

The results of catches in about 20 traps consisting of either old branches or saplings of *P. radiata*, 4–5 ft. in length and with the bark intact, buried slantwise for half their length in the soil, showed that many more larvae, pupae and adults were obtained with the old branches. This was probably due to the fact that the bark on the saplings failed to withstand the weather conditions, and soon became unattractive to the beetles. As, however, in an uncompleted experiment, oviposition occurred as readily in thin-barked traps, it is thought that these might be as efficient as thick-barked ones, since the larvae might be automatically destroyed with the perishing of the bark. The traps should be set late in July and again in early January and removed in mid-September and early July respectively. Various other measures are discussed [*cf. R.A.E.*, A, vi, 117].

Uichanco (L. B.) & Villanueva (F. E.). **Biology of the Pink Mealy Bug of Sugar Cane, *Trionymus sacchari* (Cockerell), in the Philippines.**—*Philipp. Agric.*, xxi, no. 4, pp. 205–276, 8 pls., 14 charts, 4 pp. refs. Laguna, P.I., September 1932.

A detailed account is given of observations on *Trionymus sacchari*, Ckll., in the Philippines, with a list of the countries in which it occurs, descriptions of both sexes and the immature stages, and a key to the various instars of the female.

The following is largely taken from the authors' summary: The principal food-plants of the mealybug are sugar-cane, and wild sugar-cane (*Saccharum spontaneum indicum*); it may also be found on *Sorghum* and rice. In the Philippines it has a strong tendency towards ovoviviparity, the young completing their development within the females and emerging as vermiform larvae that shed their pellicles after an average of about half an hour. Oviparity apparently also occurs to a limited degree, probably as a response to certain untoward environmental factors. Parthenogenesis is very common and is apparently correlated with ovoviviparity.

In studies on the life-cycle the following average figures were obtained. The six nymphal instars of the female occupy 17·89 days and its adult life 35·15. Reproduction begins 20·54 days after emergence, the number of young produced being 200·81. Dispersal apparently occurs largely in the first instar, and may also take place in the second and third. Males were rarely found and constituted only 8·76 per cent. of the progeny. The five nymphal instars of the male occupy 14·58 days and the pupal stage 6·45. At mean monthly temperatures of from 26 to 30·5°C. [78·8–86·9°F.], with average maxima of from 29·1 to 35·9°C. [84·38 to 96·62°F.], the nymphal period varies directly, and the period from the emergence of the adult to first production of young inversely, with the temperature. A high relative humidity apparently exerts an important effect on the life-history and reproduction. The total duration of the life-cycle of the female at a monthly mean relative humidity below 80 per cent. was about 4·04 days longer than at one above. The most sensitive reactions as to changes in duration of the nymphal stage occurred at prevailing temperatures of about 26°C. which was the lowest mean range obtained in the present work, and

the least in the upper temperature limits. It is therefore considered that the optimum temperature for development is about 26°C. In comparison with years in which the monthly temperature ranges were lower and the amount of rainfall more, a high prevailing temperature with less rainfall during the year apparently considerably reduced cane infestation. Rainfall apparently has a temporary effect on the degree of infestation, the downward fluctuation in the percentage of infested stalks being evident only in the month immediately following one with heavy precipitation. Canes may apparently be infested with the same degree of severity at all stages of their growth, and no variety has been found to be markedly resistant to infestation.

The ants observed attending the Coccid include *Solenopsis geminata rufa*, Jerd., *Paratrechina* spp., and *Polyrhachis dives*, F. Smith, *Solenopsis* and *Paratrechina* also assisting in its spread. Of its natural enemies a fungus, *Aspergillus* sp., is by far the most important. Others include three species of the Encyrtid genus *Anagyrus*; the Coccinellids, *Cryptogonus orbiculus*, Gyll., and *Scymnus* (*Pullus*) sp.; the Forficulids, *Proreus simulans*, Stål, and *Chelisoches morio*, F.; and a mite of the genus *Rhizoglyphus*. Attempts to establish the Coccinellid, *Cryptolaemus montrouzieri*, Muls., which was originally introduced from Hawaii in 1928, have not been successful. The control measures recommended are the treatment of cane points with insecticides, clean cultivation, and the destruction of ants. Rice should not be grown in rotation with sugar-cane.

Pemberton (C. E.). **The present Status of Sugar Cane Insects in Hawaii.**—*Proc. Ass. Hawaiian Sugar Technol. 1932*, pp. 47–49. Honolulu, 1932.

The author states that no pest of sugar-cane has been introduced into Hawaii for the past 20 years, despite the increase of communication with other countries and the introduction of a large number of new varieties of cane. As a result of considerable progress in the control of the destructive insects already present, by the introduction of their natural enemies from other countries, it is considered that the situation in Hawaii is probably more stationary than that in almost any other country in the world.

The status of various pests [*cf. R.A.E.*, A, xvi, 448; xvii, 72; xviii, 588; xix, 601; xx, 22, 572] is discussed. The species of *Anagyrus* introduced from the Philippines for the control of *Trionymus sacchari*, Ckll. [xx, 22] is recorded as *A. saccharicola*. It is rapidly spreading and proving effective in many areas. The two unidentified species of *Scelio* introduced from Malaya against *Oxya velox*, F. (*chinensis*, Thunb.) [xx, 23] are recorded as *S. serdangensis* and *S. pembertoni*, the latter being already established in two localities.

Lever (R. J. A. W.). **Notes on Coconut Pests and noxious Weeds in Fiji.**—*Agric. J. Fiji*, iv, no. 2, pp. 77–80, 5 refs. Suva, 1931. [Recd. October 1932.]

Notes are given on investigations on the Braconid, *Apanteles tirathabae*, Wlkn., liberated in Taveuni against *Tirathaba trichogramma*, Meyr. [*cf. R.A.E.*, A, xx, 604]. Observations on *Promecotheca reichei*,

Baly, a serious pest of coconut [*cf. loc. cit.*], showed that the eggs are laid after the leaves have unfolded and hatch in 2½ weeks. The adults gnaw fine lines on the lower surface of the tips of the distal leaflets, and the larvae mine in the leaves. By thus weakening the trees, this Hispid is estimated to cause a loss of 25–33⅓ per cent. of the crop. The eggs and larvae are parasitised by *Chaetostricha* sp. and *Elasmus* sp., respectively, the latter in turn being attacked by a Eulophid, *Tetrastichus* sp. Parasitism of the larvae in one locality during January was found to be 15 per cent. Since the beetle is only of importance in very dry districts, abundant rainfall plays a more important part in its control than natural enemies. Its parasites are also highly susceptible to rain, and in one locality nearly 37 per cent. of *Elasmus* sp.were found drowned in the mines. The Phasmid, *Graeffea crouani*, Le Guill., is often locally a serious pest of coconut, sometimes destroying all but the midrib of the leaf. It is most abundant on trees growing in long grass, particularly buffalo grass (*Stenotaphrum*). Banding the trunks with an adhesive, to prevent the nymphs and wingless females from ascending the trees, and smoking by lighting fires under the trees are the measures suggested. The removal of tall grass from the plantation would expose the eggs, which the females drop from the trees, to the attacks of ants. The spread of *Liothrips urichi*, Karny, introduced from Trinidad against the weed, *Clidemia hirta*, is briefly discussed [*cf.* xx, 380].

Simmonds (H. W.). **Pests and Diseases of the Banana in Fiji.**—*Agric. J. Fiji*, iv, no. 4, pp. 133–140. Suva, 1931. [Recd. October 1932.]

The usual insect pests of bananas in Fiji are discussed, and in addition a small weevil, *Polytus mellerborgi*, Boh., is recorded as occurring in the stems of the plants. Nothing is known of its immature stages, and it is considered to be of no economic importance.

Entomological Notes.—*Agric. J. Fiji*, v, no. 1, pp. 3–5. Suva, 1932.

As regards the alternative food-plants of coconut pests in Fiji, R. W. P[aine] records the occurrence of *Tirathaba trichogramma*, Meyr., on the palms, *Pritchardia pacifica* and *Oreodoxa regia*, and of all stages of *Promecotheca reichei*, Baly, on *P. pacifica* and a closely allied species. R. J. A. W. L[ever] states that an apparently undescribed species of *Apanteles* was found parasitising the larvae of *T. rufivena*, Wlk., on *Nipa fruticans* in the Solomon Islands during October 1931. This author also records the finding of *Brontispa froggatti*, Sharp, on a species of wild palm, *Ptychosperma*, in these Islands. H. W. S[immonds] reports that in an experiment in Fiji six ordinary glass fly-traps containing a bait devised by Jarvis in Queensland consisting of a mixture of 1 tablespoon of Scrubb's ammonia, 1 teaspoon of essence of vanilla, and 1½ pints of water and suspended by wires from the branches in a *Citrus* orchard caught a total of 579 gravid females and 47 males of the Trypetid, *Dacus passiflorae*, Coq., during a period of 4 weeks.

Simmonds (H. W.). **A List of Insects introduced into Fiji for the biological Control of Pests and Weeds.**—*Agric. J. Fiji*, v, no. 1, pp. 5–9. Suva, 1932.

An annotated list is given of 45 beneficial insects introduced into Fiji, 18 of which are known to be established. The following have

proved of particular value: *Ceromasia sphenophori*, Villen., introduced against *Rhabdocnemis obscura*, Boisd. (cane borer); *Plaesius javanus*, Er., against *Cosmopolites sordidus*, Germ. (banana borer); *Ptychomyia remota*, Aldr., against *Levuana iridescens*, Beth.-Bak. (coconut moth); *Cryptognatha nodiceps*, Mshl., against *Aspidiotus destructor*, Sign. (coconut scale); and *Liothrips urichi*, Karny, against the weed, *Clidemia hirta*.

SIMMONDS (H. W.). **Report on Banana Borer** (*Cosmopolites sordidus*). —*Agric. J. Fiji*, v, no. 1, pp. 10–17. Suva, 1932.

An account is given of experiments in Fiji during 1931–32 against *Cosmopolites sordidus*, Germ. (banana borer), the results of some of which have already been noticed [*R.A.E.*, A, xx, 605]. The use as traps of sections of stems or corms of banana keeps uninfested plants reasonably free from infestation. The presence of one weevil in a stool is the main attraction for others, particularly males, and once the female has begun to oviposit in a stool, a resident non-migrating population accumulates. In the majority of cases the traps intercept the migratory weevils so that a resident population is not established.

SIMMONDS (H. W.). **Biological Control—Progress Report.**—*Agric. J. Fiji*, v, no. 1, pp. 21–22. Suva, 1932.

Brief notes are given on the results of investigations on the activities of the Tingid, *Teleonemia lantanae*, Dist., introduced for the control of *Lantana* [*cf. R.A.E.*, A, xviii, 11,12, 616]. Its incidence in the field has been considerably affected by wet weather, and it has almost disappeared from some localities where it previously showed promise of being of value, but the predacious Lygaeid, *Germalus pacificus*, Kirk. [xvii, 564] is probably the most important factor in holding it in check. An inspection of areas in which *Liothrips urichi*, Karny, has been colonised on *Clidemia hirta* [*cf.* xx, 380, etc.] showed that the results of the liberations have been in general most encouraging. The weed when once attacked by the thrips becomes stunted and is soon overrun by other rapid-growing plants, which eventually kill it.

HUTSON (J. C.). **Report on the Work of the Entomological Division.** —*Adm. Rep. Dir. Agric. Ceylon 1931*, pp. D111–D121. Colombo, September 1932.

Among the many injurious insects here recorded as occurring in Ceylon during 1931 are *Saissetia nigra*, Nietn., on the leaves of young budded *Hevea* trees, and *Remigia frugalis*, F., and *Borolia venalba*, Moore, two unusual pests of rice. Three weevils previously observed on the flowering shoots and tender leaves of mango have now been identified as *Rhynchaenus mangiferae*, Mshl., *Amorphoidea* sp. and *Apion gracile*, Gerst. New records on green manure plants and cover crops include *Heterusia cingala*, Moore, *Clania variegata*, Sn., and *Psyche albipes*, Moore, on dadap (*Erythrina lithosperma*), *Etiella zinckenella*, Treit., and *Xyleborus fornicatus*, Eichh., on *Crotalaria anagyroides*, and *Mylabris pustulata*, Thunb., and *Utetheisa pulchella*, L., on *C. juncea*. Outbreaks of *Myzus persicae*, Sulz., occurred on tobacco, and Coccinellids, chiefly *Illeis* (*Thea*) *cincta*, F., were liberated for their control.

Termites attacking plants of economic importance included *Calotermes* (*Neotermes*) *greeni*, Desn., on various trees, including four new food-plants; and *C.* (*N.*) *militaris*, Desn., *C.* (*Glyptotermes*) *dilatatus*, Bugnion & Popoff, an undescribed species of *Coptotermes*, *Termes* (*Cyclotermes*) *redemanni*, Wasm., and *T.* (*Hypotermes*) *obscuriceps*, Wasm., all on tea, the last two being of secondary importance. *Coptotermes ceylonicus*, Holmgr., which was again recorded as a pest of *Hevea*, caused much damage to old tea and was found on two new food-plants during the year.

Termites affecting buildings and building materials included an undescribed species of *Calotermes* (*Planocryptotermes*), five colonies of which have now been under observation for 3½ years. Of these, three have been raised from eggs laid by neoteinic adults and the other two from those produced by winged pairs. There is at present no indication of development to the winged stage among any of these, but in the case of another colony winged adults were obtained after two years and seven months from eggs produced by a neoteinic pair. This is believed to be the first recorded instance of winged adults being bred from the wingless neoteinic forms. The collapse of a bungalow roof was due to *Termes horni*, Wasm., and extensive damage was caused to woodwork in a tea factory by *Eutermes ceylonicus*, Holmg. Tests with *Sequoia sempervirens* (Californian redwood) show that this timber, which is considered highly resistant to termite attack in certain countries, is readily attacked by subterranean termites in Ceylon. Samples of *Hopea odorata* and *Xylia dolabriformis*, which have a reputed resistance to termite attack, suffered no injury when tested against *T. obscuriceps*, *T. redemanni* and *T. horni*, and repeated attempts to establish colonies of *Calotermes* (*Cryptotermes*) sp. in these timbers failed, the insects dying in the course of a few days. In experiments carried out in an attempt to discover an effective and cheap method of ridding infested timber of termites, fumigation with 1 oz. cyanide, 1½ oz. sulphuric acid and 2 oz. water to 250 cu. ft. resulted in a mortality of 99 per cent. in 24 hours. Submergence in water was effective, but not under a period of 4 days. Fumigation with petrol vapour at the rate of 1 oz. petrol per cubic foot of space destroyed all the insects in 3 days.

Inspection of coir fibre dumps showed that *Oryctes rhinoceros*, L., does not breed in large numbers in such places [*R.A.E.*, A, xix, 741], and in laboratory tests, larvae fed regularly on coir fibre refuse alone did not survive for more than a month and during that period did not develop normally as compared with larvae fed on cattle manure, which were still alive and vigorous after 3½ months.

Preliminary experiments with certain insecticides against the various stages of *Agromyza phaseoli*, Coq., on beans showed that a tobacco spray applied daily for 10 days after germination reduces the severity of the attack to such an extent that the plants, especially those on manured plots, are able to produce good crops.

HUTSON (J. C.). **Some Insect Pests of Tea in Ceylon. The Red Borer (*Zeuzera coffeae* Nietn.).**—*Trop. Agriculturist*, lxxix, no. 3, pp. 137–148, 1 pl., 5 refs. Peradeniya, September 1932.

An account is given of the bionomics of the Cossid, *Zeuzera coffeae*, Nietn., on tea in Ceylon, where it is sometimes a serious pest of young plants in nurseries and new clearings and occasionally of older bushes.

The stages are described, and the distribution at various altitudes is shown in a series of graphs.

The following is largely taken from the author's summary: The eggs are deposited in small masses, probably in the cracks of stems or branches, and the larvae tunnel up and down the branches, sometimes penetrating a stem. The presence of the caterpillars in older bushes is usually detected by the withering of leaves on a branch and by the pellets of frass on the ground below the infested branch, these being ejected periodically through holes bored to the outside. The larval period probably occupies several months. The pupal stage, which is passed within the tunnel, lasts about a month, and the moth emerges through the hole cut by the larva before it pupates. Records made during the last 30 years indicate that the borer is distributed throughout most of the tea-growing area from about sea-level to about 5,500 ft., and is found on 30 species of cultivated plants (which are enumerated), most of which are grown in the wetter low and mid-country parts of the Island. Breeding occurs throughout the year, the generations overlapping. Although the larvae are well protected inside their tunnels, they are occasionally parasitised by a species of *Microbracon* (*Bracon*). Control measures include the removal and burning of all dead and dying plants in nurseries and new clearings and of all attacked branches of older tea. In cases where the injury has extended below the ordinary pruning level, the galleries can be probed with wire to kill the insects, or a piece of cotton soaked in carbon bisulphide or petrol can be inserted into the tunnel, which is then plugged.

PIEMEISEL (R. L.). **Weedy Abandoned Lands and the Weed Hosts of the Beet Leaf Hopper.**—*Circ. U.S. Dept. Agric.*, no. 229, 24 pp., 10 figs., 12 refs. Washington, D.C., July 1932.

An account is given of investigations in valleys of the south-western United States, particularly Idaho, on the plant succession occurring in abandoned land, with reference to its effect on the breeding of *Eutettix tenella*, Baker, the vector of curly-top disease of beet. Areas recently abandoned are covered with weeds, the majority of which are favourable to *E. tenella*, whereas in those less recently abandoned, these have for the most part been displaced by downy bromegrass (*Bromus tectorum*), perennial grasses and sagebrush (*Artemisia tridentata*), which are not susceptible to attack. Various factors, however, prevent this natural succession and bring about the re-establishment of the noxious weeds, the most important being unrestricted grazing. It is doubtful, therefore, whether perennial grasses can be effectively employed in keeping down the weeds. Downy bromegrass, which is rapid in its spread, lacks permanence; sagebrush, which also spreads rapidly, is therefore considered the most suitable cover for the purpose.

JEWETT (H. H.). **The Resistance of certain Red Clovers and Alfalfas to Leafhopper Injury.**—*Bull. Kentucky Agric. Expt. Sta.*, no. 329, pp. 155–172, 3 figs., 9 refs. Lexington, Ky., June 1932.

In continued studies [*cf. R.A.E.*, A, xviii, 489] in Kentucky during 1929–31 on the different degree of injury caused by *Empoasca fabae*, Harr., to different varieties of clover and lucerne, it was found that a

greater percentage of leafhoppers was collected in the field from the non-pubescent varieties of red clover than from the pubescent ones. Adults confined in cages with either non-pubescent or pubescent varieties or with the two together produced more nymphs on the non-pubescent plants. The numbers produced on individual pubescent varieties did not vary to any appreciable extent. Although in general the non-pubescent plants were more severely injured, experiments during 1931 showed that there does not appear to be any direct correlation between the amount of injury and amount of pubescence and that some other undetermined factor may be important in this connection [*cf.* xix, 480].

Legislative and administrative Measures.—*Int. Rev. Agric.*, xxiii, no. 9, pp. M146–M153. Rome, September 1932.

An order issued by the Spanish Ministry of Agriculture, Industry and Commerce, and dated 20th April 1932, includes the following list of insects the presence of which in consignments of plant products for import into Spain or in their country of origin will cause the prohibition of import of the plants, or parts of plants, and of other materials capable of carrying infestation : *Aspidiotus* (*Aonidiella*) *perniciosus*, Comst., and *Cydia* (*Laspeyresia*) *molesta*, Busck, on fresh fruits ; *Leptinotarsa decemlineata*, Say, on tubers, peelings and leaves of potato or other solanaceous plants ; *Dialeurodes* (*Aleurodes*) *citri*, R. & H., and allied species ; *Sesamia calamistis*, Hmps., in stalks and cobs of maize ; *Icerya purchasi*, Mask. ; *Aulacaspis* (*Sasakiaspis*) *pentagona*, Targ., on a great variety of plants and on cacao pods ; *Coccus viridis*, Green, on coffee fruits and *Citrus* plants ; *Popillia japonica*, Newm. ; *Anthonomus grandis*, Boh. ; and *Platyedra* (*Pectinophora*) *gossypiella*, Saund.

Other regulations recorded include three, under dates in March or April 1932, designed to prevent the importation into Belgium, Holland and Portugal of *Leptinotarsa decemlineata* in potatoes, etc.

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Jensen-Storch (S.). **Eine Uebersicht über die Entwicklung der Hausbockfrage in Dänemark und eine Methode zur Untersuchung des relativen Wertes der verschiedenen Konservierungsflüssigkeiten als Bekämpfungs- und Vorbeugungsmittel.** [A Survey of the Problem of *Hylotrupes bajulus*, L., in Denmark and a Method for the Investigation of the relative Values of various Liquid Preservatives as Remedies and Preventatives.]—*Anz. Schädlingsk.*, viii, nos. 9–10, pp. 101–105, 121–126, 2 figs., 18 refs. Berlin, September–October 1932. [*Cf. R.A.E.*, A, xix, 379, 740 ; xx, 456.]

Peters (G.). **Die Organisation der Schildlausbekämpfung in den Citruskulturen der Welt.** [The Organisation of Work against Coccids in the Citrus Plantations of the World (a survey of methods used).]—*Anz. Schädlingsk.*, viii, no. 10, pp. 113–119, 11 figs. Berlin, October 1932.

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Roepke (W.). **Die Bedeutung des** *Scolytus scolytus* **als Ueberträger der sogenannten holländischen Ulmenkrankheit.** [The Importance of *S. scolytus*, F., as a Carrier of the so-called Dutch Elm Disease.]—*4. Wanderversamml. deuts. Ent. Kiel* (*11.–15. vi. 1930*), pp. 153–154. Berlin, December 1930. [*Cf. R.A.E.*, A, xviii, 177.]

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